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Fiscal and Organizational Impacts of Part-Time Labor in Public Transit

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EXECUTIVE SUMMARY

BACKGROUND

The increased difficulty of obtaining transit subsidies in recent years has produced a corresponding increase in concern over operating efficiency and labor productivity. The use of part-time operators (PTOs) has emerged as one of the most widely adopted, yet controversial, methods for productivity improvement. Pioneered by a handful of transit agencies during the late 1970's, contract provisions allowing the use of PTOs became nearly universal during the early 1980's.

A typical transit agency will have about twice as many vehicles in operation during the peak hours as at midday. PTOs provide a simple, efficient way to staff those peak hour vehicles. Without PTOs, the agency must choose between two inefficient solutions. It can either schedule long split runs -- a few hours work during the morning and evening peaks -- and then give substantial amounts of premium pay to the operators in compensation for the burden of the long splits; or it can schedule short, single-peak runs, and then pay substantial amounts to bring wages up to the eight hour daily guarantee. Either solution means that the transit agency pays for more labor hours than it uses. PTOs are desirable because they enable the agency to match operator work schedules to vehicle work schedules.

Transit unions have opposed the use of PTOs. They see part-time labor as a threat to their job security, their hard-won improvement in working conditions, and their premium pay. Such opposition has resulted in difficult contract negotiations and lengthy strikes.

SCOPE OF RESEARCH

Our study looks at the direct and indirect impacts of part-time labor implementation (PTLI) at five transit agencies: Municipality of Metropolitan Seattle (Seattle METRO), Orange County Transit District (OCTD), Southeastern Michigan Transportation Authority (SEMTA), Tri-County Metropolitan Transportation District of Oregon (TRI-MET), and Central Contra Costa County Transit Authority (CCCTA). Direct impacts include changes in operating costs and labor productivity. Indirect impacts include the cost of any concessions which management makes to obtain PTLI, and the performance of PTOs -- their absenteeism, accidents, and attrition.

The five case study agencies are a diverse group illustrating a wide variety of experience with PTLI. They range in size from 60 to 1100 buses, in peak/base ratio from 1.2 to 3.5, and in operating environment from "new western suburb" to "long-established northeastern city." Interviews were conducted during 1982-84, and each agency was visited at least twice. We collected detailed data on scheduling and operator performance, and we interviewed operations managers, department heads, union leaders, and vehicle operators.

EFFECT OF PTLI ON DIRECT COSTS

The major effect of PTLI is an increase in labor productivity at the transit agency. The secondary effect is a decrease in fringe benefit costs because PTOs generally receive fewer fringe benefits than FTOs. There may also be some savings from lower PTO wages: either because the PTO scale is lower, or because PTO turnover keeps the average operator on a lower part of the wage progression.

One motivation for the current research was the chance to follow up our earlier study (Chomitz and Lave, 1981), which had developed estimates of the likely savings to be expected from PTLI. (N.B., there is not a complete overlap of case studies between the earlier report and this one, and the designations do not correspond; e.g., the 1981 "B" does not correspond to OCTD, and so on.)

How Much Does PTLI Save?

Unfortunately, the answer is inherently ambiguous in many, perhaps most, situations. Suppose a transit agency wins the right to use PTOs, which could improve the efficiency of its current schedule by 7%; but it decides to increase peak hour service, and the new peak/base ratio is inherently 5% less efficient. The end result is a 2% reduction in operator costs. Is the saving from PTLI 2% or 7%? Furthermore, suppose that taking PTOs away from the new, peakier schedule would increase costs by 11%. Now there are three numbers to chose among, and there is no theoretically correct answer. Unless the peak/base ratio remains constant, the best that can be said is, "The agency won the right to use PTOs and decided to spend some of those potential savings to expand peak hour service."

This is exactly the situation at Seattle METRO: it increased peak service during PTLI, though still producing a net drop in costs. We estimated the partial contribution of PTLI toward the overall result as 5%, and note that the saving would have been considerably higher than 5% if the agency had not expanded peak hour service. At OCTD, peak service was reduced during PTLI, producing a greater effect than could have been achieved by PTLI alone.

We were also able to estimate PTLI savings at two agencies where the service profile was held constant. These provide appropriate instances to check the forecasting procedures developed in the 1981 study. At SEMTA the actual saving was 2.9% compared to our forecast of 3.7%. At TRI-MET the actual saving was 2.6% compared to our forecast of 2.7%. That is, the forecasts are a bit optimistic, but this is the expected result: the 1981 forecasts were deliberately formulated as upper bounds on PTLI savings. They were produced under a number of optimistic assumptions, justified by the fact that even a "best case" analysis of PTLI effects was considerably below some of the claims being made for PTLI at that time.

The savings above apply only to operator wages. Since such wages are about half of total operating costs, these savings should be cut in half to see their importance to the agency's yearly budget.

We were only able to estimate fringe benefit savings for two agencies. In one, PTOs were given full benefits, hence there were no savings. In the other, the PTOs received a relatively typical package of fringes, and the result was a 2.3% saving in

operator costs; which compares well with the Chomitz and Lave (1981) estimate of approximately 2%.

The Effect of Operating Environment on PTLI Savings

The effect of PTLI is dependent upon two major factors: the peak/base ratio and the existing work rules. Other things being equal, the higher the peak/base ratio, or the more restrictive the work rules, the greater the saving to be expected from use of part-time labor. By reworking the results of the Chomitz and Lave (1981) study, we were able to devise a relatively simple method for predicting PTLI savings as a function of the pre-existing schedule efficiency.

Schedule efficiency is measured as the ratio: hours-of-pay/hours-of- driving. If an operator receives ten hours of pay for eight hours of driving, the ratio is 1.25. By custom, driving-hours are called platform-hours, and the schedule efficiency ratio is usually shortened to the "pay/plat" ratio. Pay/plat can never get below about 1.04 because a small portion of the workshift is spent on non-driving activities such as checking in. But most transit agencies operate in the range of 1.15-1.25, which indicates significant room for improvement.

As noted above, expected PTLI savings depend upon the current peak/base ratio and work rules. Since the pay/plat ratio summarizes the joint effects of these two factors, it is a better predictor of PTLI savings then would be obtained from using peak/base or work rules alone. SEMTA provides a good illustration of the superior predictive power of the pay/plat ratio. It has an unusually high peak/base ratio, 3.5; hence a naive use of guidelines provided in the 1981 study would have predicted large savings. In reality, PTLI only produced a 2.9% saving, because SEMTA also has unusually loose work rules. The atypical nature of SEMTA is immediately apparent from its comparatively low pay/plat ratio (1.16). Since the new prediction method (summarized in Figure 2-1) focuses directly on pay/plat, it would not have been been as easily misled as a method which focuses on the peak/base ratio.

We concluded that either the 1981 tables (if used with good judgement), or the direct use of the current method, would give generally reasonable forecasts of the savings to be expected from PTLI.

INDIRECT EFFECTS: RELIABILITY, EFFECT ON FTOS, COST OF GIVE-BACKS

When the use of PTOs was first proposed, one of the principal concerns was whether PTOs would be as committed and reliable as full time operators. We concentrated on two aspects of PTO job performance: absenteeism, and accidents.

Analysis of Absenteeism

Our analysis showed that part-time work has inherently lower absenteeism. PTOs have lower sick rates than FTOs, even when both receive identical sick pay benefits: whether the benefits were identically high or identically low. We found this result in cross section data and we found it when we followed identical cohorts of drivers moving from PTO to FTO, or from FTO to PTO, status. We also reached the same conclusion when we factored out the effects of probation on the behavior of PTOs.

We found that increases in sick pay benefits cause an increase in absenteeism. Although the sick pay differences between PTOs and FTOs are not sufficient to

explain the difference in absenteeism, sick pay does matter. Specifically, we found that increases in the amount of paid sick leave available to an operator cause an increase in observed absenteeism. We found this result for FTOs, when comparing those with sick pay to those without; and we found this result for PTOs, when comparing those with sick pay to those without. Finally, we found this same result when we tracked the sick rates of FTOs over time as they moved into jobs with higher amounts of paid sick leave. Each successive increases in sick-pay raised the sick-rate by about half of the increase, e.g., a 4-day rise in potential sick pay produced about a 2-day rise in absenteeism.

Finally, irregular work causes increases in absenteeism and accidents. This is supported by data from a single transit agency, but it is the theoretically expected relationship.

Analysis of Accident Rates

Only one agency provided sufficient data to permit us to fully standardize for differences in driving exposure between PTOs and FTOs. At that agency, holding constant hours of driving exposure, years of experience, and the daily time-pattern of accident hazards, we found that PTOs had lower accident rates than FTOs. At the other agencies, using rough, unstandardized data, PTO accident rates were well within the range of the FTO rates.

Attrition Effects

There is a tendency to hire the "wrong" people for part-time work. First, casual estimates from managers or unions at all five agencies indicate that 70-85% of the PTOs really want full time work. Second, at one agency with detailed data available, PTO quit-rates go up when more jobs are available outside the transit industry, and they go down when area-unemployment increases. The consequences of hiring the wrong part-timers are varied. Higher attrition produces higher training costs but lower average wages for PTOs -- because new PTOs are constantly coming in at the start of the wage progression. Higher attrition also produces higher accident costs because a higher proportion of the PTOs will be on the low-experience portion of the accident curve. (This does not contradict the prior conclusion; experienced PTOs will have even lower rates than the average PTO.)

Effects on FTOs

Our research shows that impacts of PTLI on full-time drivers are mixed. First, unions have been highly successful in protecting full-time positions. Thus PTOs have been hired primarily through service expansion, and they have been lost as a result of service reductions. Second, PTLI does cause a reduction in overtime and premium pay for full-time drivers. On the other hand, those special pay categories were created to compensate operators for long, onerous runs. Thus the loss of these runs should offset most/all of the loss of the special pay. Third, days-off for FTOs have not been adversely affected by PTLI; furthermore, if restrictions preventing PTOs from working on weekends were lifted, PTLI could result in more weekends off for FTOs. Finally, the only uncompensated loss to FTOs has been the reduction in "gravy" runs, those with low-work and high-pay, e.g. situations where an operator had a 6 hour straight run, but received 8 hours of pay.

Extensions of the PTO Concept

Some extensions of the PTO concept would benefit everyone. Allowing PTOs to work weekends gives them the extra pay they want, and gives FTOs the free

weekends that they want. Allowing FTOs to do an occasional, temporary stint of part-time work broadens their range of choices, and opens up extra pay opportunities for PTOs. This has been tried at one agency, and the FTOs say it adds a new dimension of flexibility to their options.

How Much Does It Cost to Win the Right to Use PTOs?

What is the value of the bargaining concessions that management trades to labor in order to win PTLI? Direct measurement is extremely difficult, e.g. was the 6.3% wage increase at agency "X", that accompanied PTLI out of line with what might otherwise have been expected? The problem is further complicated by the variety of possible items that can be bargained and the difficulty of evaluating the overall effect.

We decided to concentrate on the possible givebacks in wages and fringe benefits. Using regression analysis on a cross section of 41 transit agencies, holding constant the effects of agency size and regional wage levels, our best estimate is that management traded a 6% increase in fringes and 3.7% increase in wages for the right to use PTOs. The fringe benefit estimate is statistically significant; the wage increase estimate is not quite statistically significant, though the estimated giveback is strikingly consistent across different equations. Since the cost of these estimated givebacks is about equal to the cost saving from PTLI, this issue definitely merits further investigation.

OVERALL SUMMARY

The part-time labor concept has worked: it does produce lower costs, the PTOs are reliable, and the negative effects on the full time operators do not appear to have been large. But the tentative evidence is that the bargaining concessions made to obtain PTLI may have been as large as the PTLI savings. The implication for the research community is that more work is needed on this topic. The implication for transit agencies is that unusual care must be used in evaluating the dollar cost of any givebacks made to win PTOs.

For agencies that already have low pay/plat ratios, attention to absentee policy and extraboard staffing will probably give larger savings with less danger of costly bargaining tradeoffs.

The best way to forecast PTLI savings is via a detailed experimental run cut for the specific transit agency. But Figure 2-1 provides a quick method for making approximate forecasts.

A number of expansions of the part-time labor concept are worth exploring. For agencies with high pay/plat ratios, there will be additional savings associated with raising the percentage of PTOs allowed. For any agency, the use of PTOs for weekend work and the option of allowing FTOs to bid for a stint of temporary PTO work, will provide general benefits for all the parties involved.

CHAPTER ONE

INTRODUCTION

BACKGROUND

During the past decade, the U.S. transit industry has made a concerted effort to contain its ever-increasing operating deficits and halt the long term decline in productivity. Faced with the alternatives of cutting service, increasing fares, or reducing service costs, transit agencies have developed and implemented a number of actions aimed at the latter choice. These actions have frequently focused on improving labor productivity, since labor is the largest single component of transit operating costs.

The use of part-time operators (PTOs) has emerged as one of the most widely adopted, yet controversial, methods for improving productivity. Pioneered by a handful of transit agencies during the late 1970's, contract provisions allowing PTOs became nearly universal during the early 1980's. A recent APTA survey indicates that more than nine out of ten U.S. agencies have secured the right to employ PTOs, and the great majority currently exercise that right.

The purpose of using PTOs is to match operator work schedules to vehicle work schedules: PTOs can be assigned the short pieces of peak-period work that are very costly to operate with full-time operators. Transit unions have opposed PTOs: they fear a loss of their premium pay and a loss full-time jobs. Such opposition has resulted in strikes at several major transit agencies.

Despite the obvious importance of these issues, little research has been performed on the actual consequences of utilizing PTOs. Two studies have conducted simulations based on actual transit agency data to estimate impacts of PTOs on operating costs.[1,2] More recently, at least two national surveys of PTO

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[1]K.M. Chomitz & C.A. Lave (1981). Part-time labor, work rules, and transit costs. Irvine, CA: University of California, Institute of Transportation Studies and School of Social Sciences.

[2]I. Moore & E.J. Dosman (1981). The potential for part-time labor in urban transit. RTAC Forum, 3(2), 48-58.

utilization in the U.S. have been conducted.[3,4] Only one case study documents the actual experiences of PTO utilization.[5]

Our research conducts a comprehensive analysis of the impacts of PTO utilization. Both direct and indirect impacts are examined. Direct impacts include changes in operating costs related to schedule, wages, and fringe benefits. Indirect impacts include cost-related issues such as absenteeism, turnover and safety as well as organizational issues such as impacts on the FTOs.

National survey data (primarily APTA labor practices reports) were used to identify the scope of PTO utilization in the U.S. and to identify possible case study transit agencies. Five transit agencies were selected for in-depth case studies during 1982-84: Municipality of Metropolitan Seattle (Seattle METRO), Orange County Transit District (OCTD), Southeastern Michigan Transportation Authority (SEMTA), Tri-County Metropolitan Transportation District of Oregon (TRI-MET), and Central Contra Costa County Transit Authority (CCCTA). They are a very diverse group and illustrate a wide range of experiences with part-time labor. The agencies range in size from 60 to 1100 buses, in peak/base ratio from 1.2 to 3.5, and in location from "long-established Northeastern central city" to "new western suburb."

The case studies included the collection of data on scheduling, expenses, personnel, and safety. At least two site visits per agency were made. Extensive interviews with transit managers, department heads, union leaders and operators were also conducted. Since the research took place over a two-year period, at least one contract negotiation occurred at each agency during our study.

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[3]COMSIS Corporation and Gorove/Slade Associates Inc. (1984). Methods for determining the use of part-time operators in the U.S. transit industry. Cambridge, MA: U.S. Department of Transportation, Transportation Systems Center. (Draft).

[4]MacDorman & Associates (1985). Use of part-time operators. (NCTRP Project 60-1). Washington D.C: Transportaton Research Board, National Cooperative Transit Research Program. (Draft).

[5]J. Attanucci, N.M. Wilson, & D. Vozzolo (1984). An assessment of the use of part-time operators at the Massachusetts Bay Trasportation Authority. In Transit Performance Evaluation and Auditing. (Transportation Research Record No. 961). Washington, D.C: Transportation Research Board, pp. 21-28.

This report begins with a discussion of the reasons why part-time labor is viewed as an effective method for improving labor productivity. Next, the results of earlier studies are discussed. Then, a short description of part-time operator utilization in the U.S. is presented. Results of the analyses are presented in two following chapters. Chapter Two discusses direct impacts, namely impacts on schedules, wages and fringe costs. A discussion of bargaining costs of PTO adoption is also included. Chapter Three discusses indirect impacts: absenteeism, turnover, supervision, training, safety, recruitment, and impacts on full-time operators. Chapter Four presents an overall assessment of the benefits and costs of part-time operators, and some suggestions for better utilization of PTOs. Detailed case studies of part-time labor utilization for the five transit agencies used in our analysis are presented in Appendix A.

WHY PART-TIME OPERATORS?

Peak period transit service is inherently inefficient[6, 7] The size of the transit agency (number of operators, vehicles, and garages) is determined by peak service requirements, but these resources remain underutilized during the rest of the day.

Labor is a prime example. It is inefficient to assign peak service to a full-time operator, because the operator is not needed during midday. Consequently, not all operators can be assigned an unbroken eight hour shift. Many will be assigned a split run, characterized by a long break between two shifts of driving. Other assignments, though uninterrupted, will be substantially shorter or longer than eight hours, due to the exigencies of scheduling.

The diversity of assignments has fostered a complex system of operator compensation, featuring a variety of bonuses, guarantees, and premiums, together with an involved procedure for assigning work to operators. This system, which is embodied in the transit agencies' work rules, seems to have been shaped by two goals. First, it attempts to match compensation to the burden of the assignment.

6K.M. Chomitz & C.A. Lave (1981). Part-time labor, work rules, and transit costs. Irvine, CA: University of California, Institute of Transportation Studies and School of Social Sciences.

7R. L. Oram (1978). Peak period supplements: The contemporary economics of urban bus transport in the U.K. and U.S.A. Progress in Planning, 12(2), 81-154.

Runs which demand more than eight hours' driving time typically earn overtime payments. Split runs with an inordinate spread time -- the elapsed time between first sign-on and final sign-off for the day -- earn a spread premium similar to overtime. Thus a operator who reports for work at 6 AM, drives for four hours, has a four hour break, and drives again from 2 to 6 PM, may earn premium pay for all work past the eleventh hour -- i.e., time and a half for work past 5 PM. The underlying rationale is apparently that few operators can make effective personal use of the midday break, hence such breaks deserve extra compensation.

The second goal of the work rules is to specify a payment floor; most work rules typically guarantee each operator eight hours of daily pay. Operators whose assignments are less than eight hours receive makeup or guarantee pay for the difference between their actual work and the guaranteed minimum.

As a result of these work rules, pay hours inevitably exceed work hours (also called platform hours); and the ratio of pay hours to platform hours is a measure of schedule inefficiency. In the absence of PTOs, a transit agency with a highly peaked service schedule would have an inefficiency ratio in the range of 1.2 to 1.3. But even an agency with a perfectly flat schedule will have a ratio of about 1.04 because of the non-driving time required for checking in, layovers, etc.

"Inefficiency" is used here in a neutral sense. To say that an assignment schedule is inefficient is not to suggest that the bonuses and premiums are unearned. As noted above, there is an excellent rationale for these payments -- they are compensation for inconvenient work hours -- though one might question whether the size of the payments is correct. Those rationales, however, apply to full-time operators. If the agency could find operators who only want short pieces of work, there would be no need for guarantee payments or spread premiums. Schedule inefficiency could be reduced by assigning peak-hour work to part-time operators, and the remaining full-time operators would be assured of desirable eight-hour straight runs. This was the original motivation for implementing part-time labor in transit operations.

Transit agencies can use the cost-saving potential of PTOs in three ways. First, PTOs can replace full-time operators, perhaps through natural attrition, on existing peak hour runs, thus reducing the operating deficit. (When subsidy constraints are severe, such cost reductions reduce the need for fare increases or service cutbacks.)

Second, PTO's can be used to expand peak service. While additional peak service would be prohibitively costly if full-time operators were used, it is relatively

less expensive to expand with PTOs. Many transit agencies consider peak service their first priority and wish to expand it whenever possible. In addition, some transit agencies have an implied mandate to provide peak service by virtue of their subsidy arrangements, e.g. where earmarked local subsidies are aimed at providing better transit services for commuters.

Finally, PTOs may enable transit agencies to reduce unproductive day-base service. Many transit agencies keep excess vehicles in service at midday because there is little additional cost involved: the peak-period full time operator is guaranteed eight hours of pay anyway, so he might as well be driving, even if the service is not needed. Thus PTOs enable transit agencies to tailor service to actual demand.

While the incentive for using PTOs is largely based on expected cost savings from the direct impacts of PTOs, union opposition has been based on indirect impacts. Of primary concern are security of employment and working conditions. Full-time operators fear that full-time positions may be replaced by part-time positions. In addition, the existence of another class of operators without guarantee or premium pay provisions is seen as a threat to preserving hard-won work rules.

Union opposition has also centered on operator reliability. It was reasoned that PTOs would be less reliable, subject to higher absence and turnover rates, and subject to higher rates of accidents and passenger complaints because the inferior working conditions of the part-time job would attract less capable and committed workers. Should these concerns prove to be accurate, any PTO cost-savings would, of course, quickly erode.

Since the right to use part-time operators must be won through contract negotiation, it follows that management would have to give up something in order to win that right. Thus, an added dimension of part-time operator impacts are the concessions made at the bargaining table and their impact on expected cost savings.

PART TIME OPERATOR IMPACTS: EVIDENCE FROM PREVIOUS STUDIES

The most comprehensive study of direct impacts was that of Chomitz and Lave.[8] This study found that potential cost savings of part-time labor are very

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[8]K.M. Chomitz & C.A. Lave (1981). Part-time labor, work rules, and transit costs. Irvine, CA: University of California, Institute of Transportation Studies and School of Social Sciences.

sensitive to the agency's operating environment. In particular, available savings are highly dependent on the peak/base ratio of the schedule, and on the rules governing spread premium payments and maxium spread time. When the service schedule is peaky, the spread premium payments are generous and the maximum spread time is short, inefficiency is high, and there is substantial scope for savings. On the other hand, agencies with a relatively flat service schedule, non-restrictive maxium spread times, or which pay spread premiums only in exceptional circumstances, have comparatively little to save by implementing part-time labor.

The interrelations between peak/base ratio, spread rules, and the savings from part-time labor were quantitatively assessed by Chomitz and Lave. Data for the investigation consisted of five actual service schedules taken from transit agencies spanning a spectrum of peak/base ratios from 1.5 to 3.9. Three alternative sets of work rules were considered. The three sets differed in spread premium threshold (the spread time beyond which operators earn a time and a half bonus) and maximum spread time (the maximum allowable spread time). The scheduler tries to pair morning and evening peak hour assignments so that each pair falls within the maximum spread. Any pieces of work (trippers) which cannot be so paired are assumed to be worked by a operator who receives the eight-hour daily guarantee. These unpairable trippers are extremely inefficient, as each may comprise only three or four hours of actual driving. The three sets of spread rules considered were: 13 hours maximum/12 hours threshold; 13 maximum/10 threshold; and 12 maximum/10 threshold.

Chomitz and Lave computed the labor costs for providing each of the five service schedules under each of the three sets of spread rules, given three different assumptions about part-time utilization. The part-time scenarios were: no part-time operators; part-time assignments restricted to 10% of the total number of full-time operators; and part-time assignments restricted to 20% of full-time operators. Thus a total of 45 scenarios were costed out.

Costs were computed via experimental run-cutting*. Using RUCUS, a computerized scheduling program, Chomitz and Lave produced an actual operator assignment schedule (run cut) for each scenario. Run cuts are the basis for an agency's operator payroll, so that an "experimental" run cut is more than just a

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*Run-cutting is the process of assigning buses and drivers to the service schedule. See Chomitz and Lave, 1981, Appendix A.

TABLE 1-1
POTENTIAL SAVINGS IN OPERATOR COST FROM PART-TIME LABOR
Assuming 10% (or 20%) PTOs Allowed, with One Tripper/Day for each PTO.
Based on change in schedule efficiency only.

City	Peak/ Base	SPREAD RULES 13/12[a]	13/10	12/10
A[b]	3.9	3.6	4.3	7.5
		(5.6)[c]	(6.9)	(13.1)
B	2.5	2.0	3.8	7.3
		(3.1)	(4.6)	(10.6)
C	2.0	3.1	3.4	5.1
		(3.5)	(4.7)	(7.6)
D	2.2	2.2	2.5	3.5
		(3.8)	(4.5)	(5.6)
E	1.5	1.3	1.9	1.9
		(2.3)	(2.5)	(2.9)

a: 13/12 means a 13 hour maximum spread time, and spread premium pay after12 hours of spread.
b: Table is based on the 1981 study; Cities "A" - "E" in that study are not the same as Seattle METRO - CCCTA in the current study.
c: Figures in ( ) are for 20% PTO allowance with one tripper/day.

simulation of some unknown process; rather, it is a dry run of an actual payroll determination.

The results of these calculations are shown in Table 1-1. This table shows only the cost-savings purely due to the change in schedule efficiency; it ignores changes in fringe benefits. The table bears out the predicted relation between spread rules, peak/base ratio, and the savings from PTOs. City A, with the peakiest service schedule, can realize the greatest savings from part-time labor implementation. City E, the least peaky, derives the least benefit, and the cities with intermediate peak-base ratios realize intermediate savings. For any given schedule, stricter existing spread rules are unequivocally associated with greater potential savings.

Chomitz and Lave also examined the impact of differential fringe benefits. As will be discussed in a later section of this chapter, PTOs typically receive fewer fringe benefits. FTO (full-time operator) fringe benefits typically amount to about 50% of salary earnings (fringe benefits include vacation, holiday and such pay, health insurance, retirement benefits, social security and unemployment insurance). PTO fringe benefits are typically limited to social security and unemployment, which amount to approximately 10% of direct wages. Table 1-2 gives cost savings

estimates which include the reduced fringe benefits. The effect is a rather consistent additional savings of one to two percent. Thus, the Chomitz and Lave estimates indicate labor cost savings of from 3 to 14 percent given typical wage and fringe policies.

Of course, management must bargain to win the right to use PTOs, and will have to trade something in return. The Chomitz and Lave study provides some interesting speculation on how bargaining concessions might erode the benefits of PTOs.

TABLE 1-2

POTENTIAL SAVINGS IN OPERATOR COSTS FROM PART-TIME LABOR

Table 1-1 Plus Added Savings From Lower PTO Fringe Benefits

City	Peak/ Base	SPREAD RULES 13/12	13/10	12/10
A	3.9	4.4	4.9	8.2
		(7.2)	(8.3)	(14.5)
B	2.5	3.0	3.6	8.1
		(5.1)	(6.3)	(12.7)
C	2.0	4.1	4.3	6.4
		(5.7)	(6.4)	(9.7)
D	2.2	3.1	3.3	4.0
		(5.5)	(6.0)	(7.1)
E	1.5	2.5	3.0	3.0
		(4.5)	(4.7)	(4.5)

See footnotes for table 1-1.

A similar, but less comprehensive, study of part-time labor impacts was conducted by Moore and Dosman.[9] Their simulations were based on data from the Toronto and Ottawa transit systems. In contrast to Chomitz and Lave, they assumed no limit on the number of PTOs that would be employed. Rather, PTOs are assigned to all runs which have excessive premium pay. (It should be noted that both studies assume FTOs can be replaced by PTOs, e.g. there is no protection of full-time positions). Table 1-3 gives results of a simulation for one of the Toronto

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[9] I. Moore & E.J. Dosman (1981). The potential for part-time labor in urban transit. RTAC Forum, 3(2), 48-58.

Transit garages. No information is given on the peak/base ratio or work rules, but the range of cost savings is the same as that given in Chomitz and Lave.

A similar analysis of Ottawa Transit indicated that part-time operators would generate no significant cost savings. Ottawa has quite unusual work rules: low seniority regular operators are guaranteed 80 hours in 2 weeks, and must work 13 out of every 14 days -- 6 hours/day on weekdays, plus weekend work to make up the 80 hour guarantee. This avoids make-up payments for short weekday assignments, and covers all of the (paired) tripper work. In this case, the "6 hour man" performs the same function as the PTO.

TABLE 1-3
POTENTIAL SAVINGS OF PART-TIME LABOR, GIVEN UNLIMITED USE OF PTO'S
Canadian Example

Work Assigned to PTOs	# of FTOs	# of PTOs	Tot.Pay Hours	% Saving	Yrly Sving[a] per PTO
None	445	0	4383	0%	0
Trippers (unpaired)	445	36	4290	2%	$5,208
Specials[b]	393	75	4133	6%	6,720
Runs with Premium >100 min	363	105	4022	8%	6,931
Runs with Spread > 10 hours	242	259	3780	14%	4,717

a: Based on wage of $8.00/hour
b: Specials are runs with the largest amount of make-up time
Source: Moore and Dusman, 1981, p. 55

EMPIRICAL EVIDENCE: THE MBTA STUDY

Only one previous in-depth empirical study on PTO impacts has been performed: a case study of the Boston MBTA experience.[10] The impact of PTOs on operating costs, accident rates, absenteeism, and turnover was examined.

PTOs were hired at MBTA in 1982 after lengthy litigation. Chronic financial problems had led to state legislation in 1980 which granted MBTA management extensive authority in hiring and assigning work, not withstanding existing labor agreements. The use of PTOs was included in this legislation. The MBTA union

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[10] J. Attanucci, N.M Wilson, & D. Vozzolo (1984). An assessment of the use of part-time operators at the Massachusetts Bay Transportation Authority. In Transit Performance Evaluation and Auditing. (Transportation Research Record No. 961). Washington, DC: Transportation Research Board, pp. 21-28.

never agreed to these changes, and some aspects of the PTO assignment practices remain in litigation, namely the limit on number of PTOs who can be hired, and whether FTOs can be replaced by PTOs.

The first PTOs were former FTOs who had been laid off in the service cutbacks of 1981. By 1983, 280 PTOs were employed; this amounted to 19% of the FTOs. Attanucci, Wilson and Vozzolo estimated that the PTOs generated an annual savings of $5.6 million: $1.8 million from lower PTO wages and reduced make-up payments; $1.4 million from reduced spread penalty pay; and $2.4 million from reduced fringe benefit costs. The authors do not estimate the proportion this represents of labor or operating costs, but using UMTA Section 15 data, this appears to be a salary savings of about 5.3% of bus operating costs.

Studies of accident rates, absenteeism, and turnover indicated that some of the PTO cost savings have been offset by higher accident rates and higher turnover. PTO accident rates were found to be 73% higher than FTO rates after controlling for hours worked and years of driving experience. The authors estimate the annual cost of the higher accident rate at $.6 million. They point out however than one or two major lawsuits could wipe out a large proportion of PTO cost savings.

The turnover rate (terminations only) of PTOs at MBTA is about twice as high as that of FTOs. The authors estimate that training costs have approximately doubled as a result. However, this increase amounts only to four percent of the PTO cost savings.

Absenteeism was also examined by the authors. PTO absence rates have been consistently higher than FTO absence rates. The largest components of PTO absence are suspensions, terminations and unauthorized absences. In contrast, the largest components of FTO absence are sickness and work-related injuries. During the period of study, both PTO and FTO absences fluctuated significantly. The authors surmise that the high PTO absence rate was due to the confusion surrounding part-time implementation, and that the rate will probably settle below the FTO rate.

The authors conclude that use of PTOs at MBTA has significantly improved labor productivity. Further use of PTOs (on all work which currently has make-up

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11COMSIS Corporation & Gorove/Slade Associates Inc. (1984). Methods for determining the use of part-time operators in the U.S. transit industry. Cambridge, MA: U.S. Department of Transportation, Transportation Systems Center. (Draft).

time or spreads over 11 hours) could add to cost savings, provided that the PTO accident rate can be reduced.

SCOPE OF PART-TIME OPERATOR UTILIZATION

Two major surveys of part-time operator utilization have been conducted. The COMSIS corporation report[11] focused on methods for scheduling PTO work, and included data on PTO utilization based on APTA surveys and transit agency interviews. The MacDorman and Associates report[12] provides an overview of PTO utilization based on the APTA Comparative Labor Practices report series, which publishes a variety of labor practice data several times each year.

Give the apparent promise of PTOs, it is not surprising that their innovation has diffused rapidly throughout the industry. In 1977, Seattle METRO became the first large district to win the right to use PTOs. By 1981 more than half of the APTA member transit agencies had obtained a PTO provision, and by 1983 the right to use part-time labor was almost universal. (See Table 1-4).

TABLE 1-4
SCOPE OF PART-TIME OPERATOR UTILIZATION

	1981	1983
% of Agencies that allow PTOs	58%	92%
% where PTOs allowed, but not hired	18%	13%
# of PTOs allowed, as % of FTOs:		
Average	NA	13%
Range	1%-100%	1%-100%
	N = 207	N = 182

Source: Compiled from APTA data
"100%" figure includes Seattle METRO. Without Seattle the range is 1% - 40% in both 1981 and 1983.

However, Seattle remains unique in the proportion of PTOs allowed (100% of full-time operators). Excluding Seattle METRO, this proportion ranged from 1% - 40% in 1983, with an average of 13%. Thus while almost all agencies have the right to use PTOs, the proportion permitted is generally quite small.

12MacDorman & Associates (1985). Use of part-time operators. (NCTRP Project 60-1). Washington, DC: Transportation Research Board National Cooperative Transit Research Program . (Draft).

The COMSIS report indicated that 51% of the 176 contracts examined had a provision limiting the number of PTOs. Most frequently, the limit is expressed as a proportion of FTOs. Limitations on number of PTO runs or the absolute number of PTOs are much less common.

In addition to limiting the number of PTOs, most contracts also restrict the amount and type of work they do. To preserve the distinction between part-time and full-time operators, total work time is restricted: the limitation ranges from 15 to 40 hours, with an average of 28 hours. Where the limit is 40 hours, there are other restrictions which generally prevent the PTO from actually working 40 hours. These usually include maximum piece limits, or limitations on the type of work available to PTOs. Table 1-5 lists restrictions on part-time work. The percentages indicate proportions of each type of restriction. Only transit agencies which reported a restriction were counted, since the data made no distinction between "no restrictions" and "no answers." Table 1-5 shows that the most common restriction is to trippers only. Special work includes charter, night work, weekend, and holiday work. Since trippers are usually peak and weekday only, we can combine the first three categories; thus 56% of the restrictions limit PTOs to weekday peak period work.

TABLE 1-5
RESTRICTIONS ON PART-TIME OPERATOR WORK

Number	% of Total
Trippers Only	25	48%
Weekday Only	3	6%
Peak Only	1	2%
Trippers and Special Work	15	29%
Special Work Only	7	13%
School	1	2%
Total	52	100%

Source: Compiled from APTA survey data, 1983.

To protect existing full-time jobs, many contracts require that PTOs be laid off first during any general cutbacks. Table 1-6 indicates that in 1984 41% of transit agencies which use PTOs have such a provision. An additional 7% have a lay-off provision which is applicable only under certain circumstances. (Unfortunately, the APTA survey provides no explanation of the specific conditions of these provisions.) Some contracts also require that all full-time operators be rehired before any PTOs,

while others require that the size of the full-time workforce be guaranteed. As long as the agency is stable or expanding, these provisions cause no problem. However, if budget problems ever cause a service reduction, the agency must layoff its most productive operators first, namely the part-timers. As the case studies demonstrate, this provision caused many transit agencies to lose their PTO's during the period of service cutbacks and fiscal problems in the early 1980's.

TABLE 1-6
PTO LAY-OFF PROVISION

	Number	% of Total
PTOs must be laid off first	68	41%
Laid off first in some cases*	12	7%
No lay-off provision	87	52%

*The lay-off provision is applicable only under some circumstances.
Source: Compiled from APTA survey data, 1984.

Survey data indicates that PTOs are almost always union members (and pay the same dues as FTOs), and are paid on the same wage scale as FTOs. Since the wage progression is based on work hours, it requires more calendar time for a PTO to reach the top of the scale. Table 1-7 shows that for the average PTO, it takes 3.4 years to reach the top of the wage scale compared to 2.4 years for the average FTO. Since the tenure of PTOs tends to be shorter than FTOs, the average PTO wage is lower than the FTO average. Pay guarantees are generally not provided to PTOs (53% of the 1983 APTA sample). When they exist, they range from 1.5 to 2.0. hours.

TABLE 1-7
PART-TIME AND FULL-TIME WAGE PROGRESSION

Average work hours required to reach top rate	4938
Years in full-time equivalents (2080 hrs/yr)	2.4
Years in part-time equivalents (1456 hrs/yr)	3.4

*Based on the average maximum work (28 hours); calculated from the APTA data sample.
Source: Compiled from 1983 APTA data

Fringe benefits are generally much lower for PTOs than for FTOs. Most agencies offer no sick, holiday or vacation pay, no health insurance, and no retirement pay to PTOs. In cases where these benefits are provided, they are most frequently provided at reduced rates. Since fringe benefits typically amount to 50% of full-time wages, the reduced PTO fringes provide a significant source of cost savings. However, there seems to be a trend toward increasing fringes to PTOs. Table 1-8 presents PTO fringe benefits for 1983 and 1984. The data show that the proportion of transit systems providing no benefits has decreased, while the proportion providing full or reduced benefits has increased.

TABLE 1-8

PART-TIME OPERATOR FRINGE BENEFITS, 1983 AND 1984

	1983			1984		
Benefit	Same as FT	Lower	None	Same as FT	Lower	None
Sick Leave	10.9%	12.2%	73.5%	11.6%	11.6%	72.8
%Holiday Pay	12.2	16.3	69.4	16.3	15.6	63.9
Vacation	12.9	21.8	63.3	15.0	19.7	61.2
Health Ins.	13.6	15.0	66.0	16.3	18.4	60.5
Retirement	19.7	5.4	69.4	21.8	5.4	66.7

n=147

Source: Compiled from APTA data, 1983 and 1984. Percentages do not add up to 100 due to missing data.

CHAPTER TWO

FISCAL IMPACTS OF PART-TIME OPERATORS

This chapter discusses the fiscal impacts of PTOs. The first part examines impacts on service costs, and the problems of quantifying actual cost savings. The results are based on our five case studies, described in more detail in Appendix A. The second part of the chapter examines the bargaining costs of part-time labor. Results are based on data collected from 41 U.S. transit agencies.

MEASURING THE FISCAL IMPACT OF PTOS

Part-time labor can reduce costs in two ways. First, substitution of part-time for full-time operators improves schedule efficiency (the ratio of pay-hours to vehicle-hours) by reducing guarantee and spread premium payments. Second, PTOs generally receive an effectively lower wage rate and a lower fringe benefit rate than full-time operators. Against these savings must be balanced any cost-increasing bargaining concessions such as increased wages or fringe benefits for full-time operators necessary to secure union acceptance of part-time labor provisions. We examine these three issues in turn.

Schedule Efficiency

Chomitz & Lave[13] estimated that part-time operators could produce a significant reduction in labor costs, depending upon the service profile, spread limit, spread premium and the percent of part-time operators allowed. For example, given typical spread restrictions and a typical PTO contract, the reduction in direct operator pay ranges from 1.3% for a relatively flat service schedule, to 6.9% for a relatively peaky schedule. These are the reductions in direct pay; there will generally be an additional savings of about 2% because PTOs receive lower fringe

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13K.M. Chomitz & C.A. Lave (1981). Part-time labor, work rules, and transit costs. Irvine, CA: University of California, Institute of Transportation Studies and School of Social Sciences.

benefits. Finally, since operator costs are typically about half of total costs, these estimates should be cut in half to estimate the effect on total operating costs.

The Chomitz and Lave estimates were based on experimental runcuts, using five actual vehicle schedules. These estimates assume everything else is held constant: the schedule remains unchanged; and no significant concessions are given in return for the right to use PTOs, either in the form of more expensive work rules, more fringe benefits, or wage increases.

How does actual experience compare with the experimental runcuts? It would be easy to measure the financial impact of PTOs if an agency's service schedule remained unchanged through calculation of schedule efficiency before and after the introduction of PTOs. Unfortunately for the analyst, schedules do change -- and to some extent they change as a direct consequence of the decision to employ PTOs. In many cases the motivation for adopting PTOs was a desire to expand peak service. In other cases, since the contract guarantees the jobs of existing full-time operators, the agency must expand service in order to provide openings for the PTOs.

If an agency simultaneously introduces PTOs and alters the service schedule, it becomes difficult to even define, let alone measure, the savings from PTO implementation. Consider, for instance, a hypothetical transit agency which adopts PTOs and changes to a more peaked service schedule at the same time. Table 2-1 shows that there are four possible combinations for work rules and schedules whose costs we can compare. Which comparison yields the "true" value of cost savings? If we compare the old rules/old schedule combination ($10) with the new/new combination ($10), there is no change in costs.

TABLE 2-1
HYPOTHETICAL OPERATING COST OF
SCHEDULE/WORK RULE COMBINATIONS

Work Rules	LOW Peak/Base (Old Schedule)	HIGH Peak/Base (New Schedule)
Old: pre-PTOs	$10	$20
New: post-PTOs	$8	$10

All the potential savings from PTOs have been spent on expanded peak service. To evaluate changes in labor productivity, we must hold constant the service

schedule, i.e., examine costs within a single column. But the left-hand column indicates a 20% saving, from $10 to $8; while the right-hand column shows a 50% saving, from $20 down to $10. Alternatively stated, under the old service schedule, use of PTOs could have saved 20%; under the new service schedule, if management were to give up use of PTOs it would double the operating costs. (Note that columnwise comparisons require experimental runcuts, since the old/new and new/old combinations were never actually put on the street.) This is not an unreasonable example, nor is it a semantic game.

The most rigorous way of dealing with this measurement problem is to present, for each agency, a two-by-two table such as Table 2-1. The disadvantages of this approach are that data in some cells may not be available (especially the lower left cell), and that it becomes difficult to concisely grasp inter-agency comparisons. We therefore adopt two conventions. First, we will base our comparisons on schedule efficiency (pay/platform ratio) rather than schedule cost. This, at least, will standardize for changes in the scale of service which leave peak/base ratio unchanged. Second, for relatively small changes in peak/base ratio, we can apply the following accounting identity to yield a decomposition of the total observed efficiency change. Let H,P be the schedule for the High peak/base schedule under part-time work rules; L,F be the efficiency for Low peak/base ratio using full-time operators only, and so forth. Then:

$$\frac{H,P}{L,F} = \frac{H,F}{L,F} \cdot \frac{H,P}{H,F},$$

and it is approximately true that

Total percentage efficiency change [L,F to H,P] =

percentage efficiency change from increased peak-base ratio [L,F to H,F] times

percentage efficiency change from introduction of part time labor [H,F to H,P].

Impact of PTOs on Operating Cost

In addition to the complication of controlling for service schedule changes when assessing part-time operator impacts, another factor prevents the direct comparison of "before" and "after" cost. This research was performed during a period when

most transit agencies faced serious fiscal constraints. Thus, in addition to use of PTOs, management was taking other actions which affect the "after" costs: absentee reduction programs; changes in wage scales, cost-of-living adjustments, and vacation pay; reductions in extraboard staffing; work rule changes, and a host of minor policy changes.

Driver absenteeism is costly because extra operators must be available to cover the absent operator's work. "Extraboard" operators generally perform this function. Because of the day-to-day fluctuations in absence rates, however, it is difficult to optimize the size of the extraboard. On a low absence day, extraboard operators may have no work, but the contract guarantees them eight hours of pay. On a high absence day, regular operators may have to be recalled from their day off and paid at overtime rates.

Two of the case study agencies had implemented absentee reduction programs, and both claimed they had achieved a high degree of success. While these programs could potentially have had a significant impact on operating costs, via decreased extraboard staffing, it was beyond the scope of this research to pursue this issue. It is clear, however, that such changes could not be separated out from PTO effects in an examination of payroll records.

Extraboard staffing policy also has direct impact on operating costs. Most agencies have a rule of thumb for extraboard staffing, e.g. 20% of the regular FTOs. But when we discussed staffing policy at the case study agencies, we learned that the size of the extraboard is determined as much by the lag between staffing and service changes as by any explicit consideration of optimal size. When schedule reductions occur, regular operators are often moved to the extraboard instead of being layed off. Thus, the extraboard becomes too large, and then gradually decreases with attrition. When service expansions take place, regular operators are taken from the extraboard, which becomes too small but gradually increases as hiring occurs. It is obvious that any over or under-staffing of the extraboard can significantly add to labor costs.

How do these factors affect our ability to trace the impacts of using PTOs? First, since none of the case study agencies had a stable service schedule during the period of analysis, extraboard staffing fluctuated, and was probably not "optimal." Second, the payroll data available were not detailed enough to enable us to hold extraboard costs constant. Moreover, all the other policy changes implemented

during this period added to the complexity of the issue. We therefore chose a more straightforward, disaggregate approach. Cost savings are broken down into scheduled costs, wage costs, and fringe costs. The aggregation of these items gives estimates of labor cost savings, assuming all other factors are held constant. That is, we are estimating PTO cost savings as if no other change took place at these agencies. This disaggregate approach should provide the transit manager with the tools to examine the impacts of part-time operators in the unique context of his or her agency.

Impact on Schedule Efficiency

Schedule efficiency is the ratio of pay hours to platform hours (roughly speaking, driving-hours) and is always greater than one, because operators are paid for report and travel time. The minimum possible, e.g., if no make-up, premium, or overtime were paid, is about 1.04. There are two possible ways to estimate the impact of PTOs on schedule efficiency. One is to use actual "before" and "after" schedule data, and attempt to control for service and other changes. Referring back to Table 2-1, this is equivalent to moving diagonally from "OLD/OLD" to "NEW/NEW," while trying to estimate "OLD/NEW." A second method is to use experimental runcut data: take the new schedule, perform a runcut under the old rules, and compare the results. This gives the within column comparison we need. However, since the new schedule would never have been adopted under the old rules, it could be argued that such a comparison overstates the savings from PTLI (part-time labor implementation).

We used both methods in our case study analysis, and the results are summarized in Table 2-2. Actual "before" and "after" schedule data were available from two agencies. In these cases, we must distinguish between efficiency changes due to adding part-time labor and those due to changes in the peak/base ratio. Any increase in peak/base reduces schedule efficiency, because a greater proportion of the runs will have either make-up or overtime pay hours. Conversely, a decrease in peak/base will increase schedule efficiency. Seattle METRO increased service by about 40%, and the peak/base ratio increased from 2.25 to 2.65. The combined effect on the pay/platform ratio was a drop from 1.20 to 1.14 during this period.

TABLE 2-2
IMPACT OF PTOs ON SCHEDULE EFFICIENCY

Observed Data:

	Service	P/B Pre PTOs	P/B Post PTOs	Change in Pay/Plat.
Seattle METRO	increased	2.25	2.65	-5.0% total
OCTD	stable	1.35	1.21	-1.6% total 0.9-1.1 due to PTOs

Experimental Data:

	% PT	P/B	Change in Pay/Platform
SEMTA	15%	3.5	-2.9%
TRI-MET	10%	2.0	-2.6%

Here we are squarely against the problem of Table 2-1. The service change is too great to allow meaningful decomposition of the total efficiency change. Clearly it would have been extremely expensive to run the new, peaky schedule without PTOs, and relative to that hypothetical scenario, the introduction of part-time labor represented a tremendous gain in efficiency. The best that can be said is that the use of PTOs allowed Seattle METRO to greatly increase peak service while simultaneously increasing overall efficiency.

OCTD reduced peak service and increased base service after adopting PTOs. A 1.6% reduction in pay/platform ratio resulted. How do we apportion this total between the drop in peak/base and the adoption of PTOs? A drop in peak/base increases the ratio of straight runs to split runs. Using average pay/platform ratios for each type of run calculated from actual runcut data, we estimate that the change in efficiency attributable to the drop in peak/base is between .5% and .7%. The remainder, .9% to 1.1% is due to PTLI. We can also estimate the upper bound of PTO schedule efficiency savings by calculating the additional pay hours required to replace PTOs with FTOs (i.e., combine all PTO work into 2 piece splits with three hours of premium pay time). This yields an estimate of 1.2%.

Cost savings estimates based on experimental runcut data are more straightforward, because the schedule is held constant. Two of the case study agencies had performed experimental runcuts. In one case, the runcuts were performed after service cutbacks which had resulted in the loss of all PTOs. The runcut data showed the cost of losing the PTOs. In the second case, the runcuts were performed in order to determine the impact of losing PTOs due to anticipated

service cutbacks. The runcut data was used to develop plans for dealing with the service cutbacks.

SEMTA has a peak/base ratio of 3.5. Its contract allows 15% PTOs. Using the full complement of PTOs results in a 2.9% reduction of the pay/platform ratio. This is substantially less than might have been expected for an agency with such a high peak/base ratio. The reason for the small change is that SEMTA already had an exceptionally efficient schedule because of pay calculation provisions which are quite favorable to management. The most important of these is a provision that prevents pyramiding of spread premiums and guarantee payments. That is, work performed past the spread threshold is applied first to the eight hour guarantee. In addition, some runs can be scheduled as 4 days at 10 hours/day with a spread threshold of 11.5 hours.

TRI-MET had a peak/base of 2.0 and was using 10% PTOs when service cutbacks became necessary. Cutting the new reduced schedule with and without PTOs indicated that the pay/platform ratio decreases by 2.6% with PTOs.

Validation of PTLI Savings Forecasts

The 1981 Chomitz and Lave study forecast the savings from part-time labor, and showed that these savings were a function of the pre-existing work rules and the schedule profile. This section begins by developing a simpler, more effective way of utilizing the results from the old report. Then we compare those forecasts to the experience at our case study agencies and conclude that the forecasts do a good job of matching the pattern of savings, but that they are optimistic as to the level of savings to be expected. This is an expected result since the 1981 forecasts were deliberately formulated as upper bounds on PTLI savings -- the climate of that time was to regard PTLI as a panacea for transit's problems, and we wanted to show that even an upper bound estimate was well below some of the claims that were then being circulated.

The Expected Savings from PTLI: A New Approach

The basic methodology of the 1981 study involved experimental runcuts on five real-world vehicle schedules: for each runcut, the vehicle schedule was held constant while changing the work rules. Hence we implicitly assumed there would be no feedback from the work rules to the vehicle schedule. This is a reasonable

assumption for small changes in work rules, but not for large ones. Suppose, for example, that the new labor contract reduces maximum spread time by two hours. A runcut using the old vehicle schedule would generate a large number of trippers, which would cause a large increase in pay/plat (the pay/platform ratio). However, a good runcutter would never allow this to happen: he would propose adjustments to the vehicle schedule, itself, to reduce the number of new trippers, and to make it easier to pair trippers into legal split runs.

The 1981 analysis produced three sets of experimental runcuts, and we now believe that one set, the "12/10" runcuts, were unrealistic. Our vehicle schedules had come from agencies with 13-14 hour maximum spreads. The schedules were not altered for our 12-hour-max-spread runcuts, hence the pay/plat ratio of our runcuts would be biased upward. In the real world, a 1-2 hour reduction in max spread would have been partially offset by an adaptation of the vehicle schedule. By the same reasoning, the results for the old TRI-MET are also biased (a point which was repeatedly noted in the 1981 study): its vehicle schedule was generated by an agency with markedly atypical work rules, hence the pay/plat ratios produced by runcuts with our standard work rules were biased upward.

Table 2-3 is calculated from the runcuts in the 1981 study (Table E-1), but it excludes the data from TRI-MET and the "12/10" runcuts. It is obvious that other things held equal, the greater the peak/base ratio at a transit agency, the greater the scope for utilization of PTOs. But it is also obvious that, other things held

TABLE 2-3
PREDICTED SAVINGS FROM USE OF PTOs:
THE CHANGE IN PAY/PLATFORM RATIO RESULTING FROM PTLI

	13/12 Spread Rules			13/10 Spread Rules		
	Pay/Plat with No PTOs	Saving from 1 Tr/PTO	Saving from 2 Tr/PTO	Pay/Plat with No PTOs	Saving from 1 Tr/PTO	Saving from 2 Tr/PTO
3.9 Peak/Base	1.27	3.6%	5.6%	1.38	4.3%	6.9%
2.4 Peak Base	1.16	2.0%	3.1%	1.22	2.8%	4.6%
2.0 Peak/Base	1.14	3.1%	3.5%	1.20	3.4%	4.7%
1.5 Peak/Base	1.12	1.3%	2.3%	1.16	1.9%	2.9%

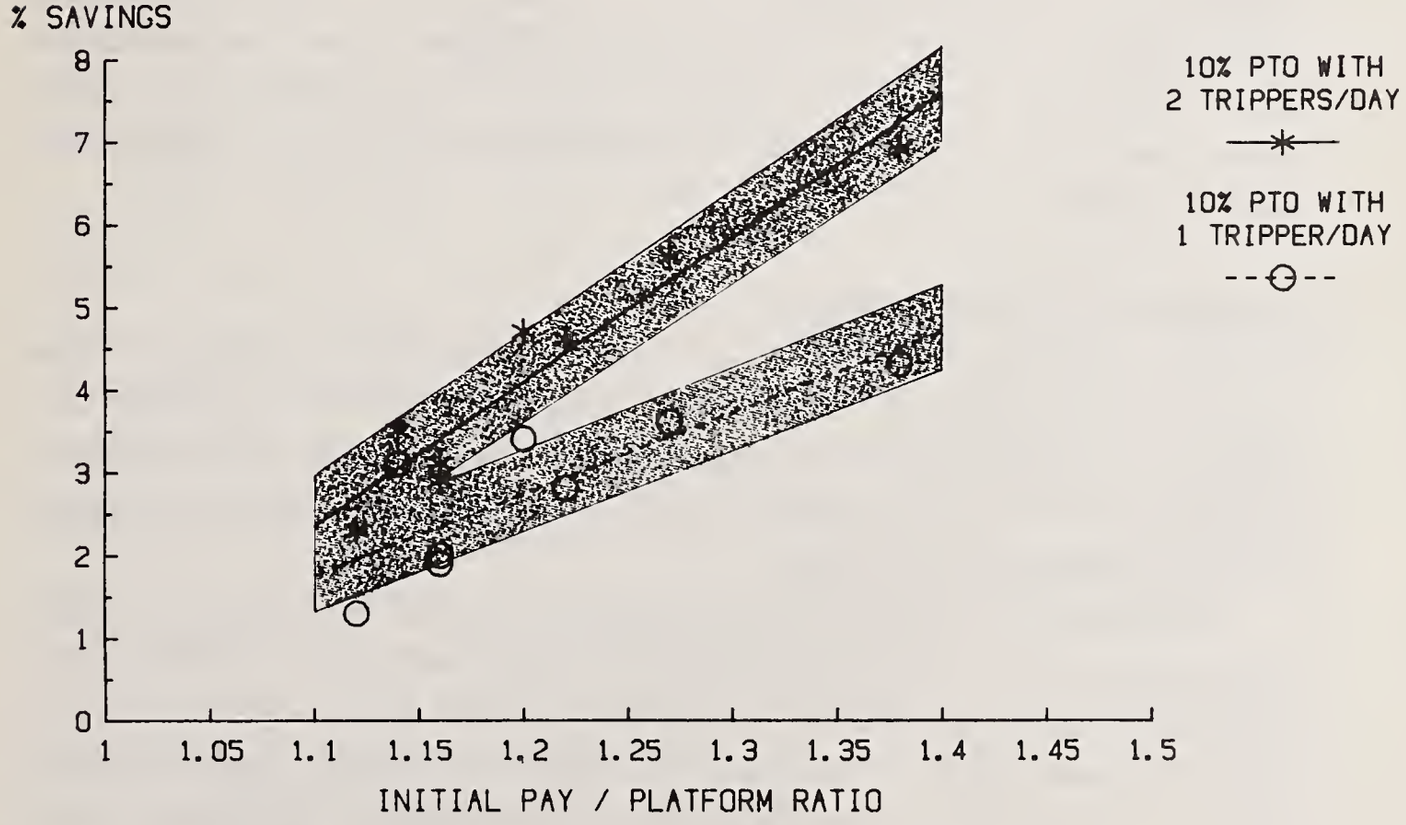
13/12 Spread Rules: 13 hours maximum spread; premium pay after 12 hours.
13/10 Spread Rules: 13 hours maximum spread; premium pay after 10 hours.
1 Tr/PTO: 1 tripper per PTO; PTOs equal 10% of total operators.
1 Tr/PTO: 2 trippers per PTO; PTOs equal 10% of total operators.
Saving: the reduction in the Pay/Platform ratio due to PTLI.
Source: Recalculation of Table E-1, Chomitz and Lave (1981).

equal, the more restrictive the work rules at an agency, the greater the scope for utilization of PTOs. The 1981 study emphasized the former relationship, and we now want to incorporate the latter one as well. The easiest way to do this is through the pay/plat ratio, because that ratio summarizes the interaction between peakiness and work rules: a peaky agency with loose work rules can have a moderate pay/plat ratio, or a flat agency with strict work rules can have an unexpectedly high pay/plat ratio, and so on.

Since the pay/plat ratio summarizes the joint effects of schedule and work rules, it should be the best starting point for predicting the potential effects of part-time labor. Figure 2-1 plots the data from Table 2-3 to show the relationship

FIGURE 2-1

SAVINGS FROM USE OF PART-TIME OPERATORS



"SAVINGS" = THE DIRECT REDUCTION IN OPERATOR PAY HOURS (DOES NOT INCLUDE REDUCTIONS IN FRINGES OR WAGE RATES)

between the initial pay/plat (pay/plat before PTLI) and the forecast savings from part-time labor. Note that these are estimates of savings not including reductions in fringes or wage rates due to PTLI, and not considering any givebacks which may be involved in gaining the right to use PTO's. The X's show the resultant saving if the PTOs are allowed to work two trippers per day; the O's show the saving if the PTOs only work one tripper.

The graph shows some degree of scatter, but overall, the relationship between initial pay/plat and predicted savings is quite good. The top line explains 91% of the variance, the bottom line explains 63% of the variance (corrected for degrees of fredom in both cases). Before using this graph to predict the outcome for some given transit agency, it should be remembered that the savings estimates are upper bounds. They were produced under a number of optimistic assumptions, justified by the fact that even a "best case" analysis of PTLI effects was considerably below some of the claims being made for PTLI in the late 1970's. Note also that these relationships hold only within the range indicated, because the pay/plat ratio cannot be less than about 1.04, and, as a practical matter, no agency would have a ratio much higher than 1.5. The range of savings predicted from Figure 2-1 then is from about 1% to 8%.

Comparison of Forecasts to Results

CCCTA has always had PTOs and has made no experimental runcuts to test their effect, hence it has no "before" data to use as a baseline. For the other four agencies, two have enough data to allow estimates of the actual dollar differences resulting from PTLI, and two have made accurate run cuts which provide enough data for a before/after comparison.

Unfortunately, we can not use the data from the agencies which have actual implementation data. At Seattle METRO, the implementation of part-time labor was accompanied by a substantial increase in peak hour service, hence the savings from PTLI were offset by the losses from an inherently less efficient schedule profile. At OCTD, the estimated saving (1.2%) is a deliberately liberal, upper bound figure. Among other problems, we could not construct a proper estimate of the cost of running trippers before and after PTLI, because the pre-PTLI runcut had unnecessary trippers to begin with. This leaves us with the two agencies that have runcut simulations.

SEMTA and TRI-MET have both done experimental runcuts to examine the consequences of PTLI. What is to be learned by comparing their experimental runcuts to the Chomitz and Lave experimental runcuts? On first thought, all the data seem equally artificial; like comparing a forecast to a forecast, rather than comparing a forecast to a result. But the results of a transit agency runcut are a "forecast" of unusual accuracy, for such a runcut is a description of how the vehicle schedule will actually be manned. Properly performed, such a runcut satisfies all the idiosyncratic clauses in the local labor agreement, and all the unusual features of the local schedule. The only significant source of error in this forecast is the potential shortfall in PTO recruiting: the runcut assumes that, say, 10% PTOs will be used to cover short runs; but, as discussed below there may be problems with keeping this 10% quota exactly filled.

At TRI-MET the chief scheduler performed an experimental runcut to measure the effects of 10% PTOs, working 2 trippers per day. The result was a 2.6% reduction in pay hours. The pay/plat ratio at TRI-MET is 1.12. The upper line in Figure 2-1 corresponds to 10% PTOs, working two trippers per day. Using that line and a pay/plat of 1.12, we would forecast a savings of 2.7%.

At SEMTA the chief scheduler performed an experimental runcut to measure the effects of 15% PTOs, working 2 trippers per day: the result was a 2.9% reduction in pay hours. The pay/plat at SEMTA is 1.16. Using the two-tripper 10% PTO line, and a 1.16 pay/plat, we forecast a saving of 3.4%. Obviously, 15% PTOs will produce a greater saving, though not fifty percent greater because the most inefficient FTO runs are transfered to PTOs first, thus each additional PTO percent produces a smaller and smaller increment to savings. The 15% line would be the next line in the series on the graph: assuming that the percentage change from the upper-line to the 15% line, would be the same as the percentage change from the bottom-line to the upper-line, we estimate a saving of 3.7%.

In summary, for the two situations where we have "real" runcut simulations to compare with our forecasts, the results are:

TRI-MET: forecast =2.7% real = 2.6%

SEMTA: forecast =3.7% real = 2.9%

Thus it is obvious that the forecasts are a bit optimistic, as they were deliberately intended to be, but still reasonable.

Wages and Benefits of Part-Time Operators

The major reason for using PTOs is their positive effect on schedule efficiency. But most transit agencies gain additional savings by paying PTOs lower fringe benefits and wages (see Chapter One). PTOs generally do not receive sick, holiday, or vacation pay, health insurance, or retirement pay. In cases where these benefits are provided, it is generally at reduced rates. As a result, the PTO fringe rate is typically about 1/3 of the FTO rate, or about 15% of the hourly wage, compared to 50% for FTOs.

Chomitz and Lave[14] had estimated that savings from a typical PTO fringe benefit package would contribute a cost reduction of about 2%, over and above the cost reduction from improved schedule efficiency. We only have before/after fringe benefit data for two agencies, and the PTO fringe benefit package at one of them is hardly typical. OCTD actually gives its PTOs full fringe benefits, hence there are no savings. TRI-MET gives typical PTO fringes -- no sick pay, vacations, retirement, or health insurance -- and their estimate of the cost savings due to lower PTO fringe benefits is 2.3%, which compares well to the Chomitz and Lave 2% figure.

Chapter One also discussed PTO wage rates, and pointed out that while PTOs are almost always paid on the same wage scale as FTOs, it takes PTOs longer to reach the top of the pay scale. In addition, many PTOs either quit or move up to full-time jobs before reaching the top rate. Hence the average PTO wage is lower. It is arguable, however, whether this constitutes a savings attributable to the introduction of part-time labor. Even in a 100% full-time force, new hires receive lower initial wage rates. There are two ways that the wage progression can result in differentially lower PTO cost. First, turnover may be higher among PTOs, so that their average tenure (and hence average wage rate) is below that of equivalent FTO new hires. Of course, these savings must be weighed against the increased turnover and training costs. A second source of savings is that PTOs will move more slowly up the wage ladder than FTOs. A PTO working four hours a day takes 102 calendar weeks to reach the one-year (2080 logged hours) wage rate. A FTO performing the same work reaches the one-year mark in 52 calendar weeks.

14K.M. Chomitz & C.A. Lave (1981). Part-time labor, work rules, and transit costs. Irvine, CA: University of California, Institute of Transportation Studies and School of Social Sciences.

We were able to obtain sufficient data on wages, pay hours, fringes and turnover rates to estimate PTO wage scale savings for two of the case study agencies. For OCTD, we calculated wage-scale savings assuming FTOs are paid at the top rate, and estimated the average PTO rate (based on PTO attrition data). The reduction in total wage cost with PTOs is 1.65% -- 1.2 % from improved schedule efficiency (fewer pay hours), and .45% from lower wages per hour. (See Table 2-4).

TABLE 2-4
IMPACT OF PTOs ON SERVICE COST AT OCTD

Catagory	Percent Change
Reduction in Pay Hours	-1.2%
Reduction in Average Wage	-0.45%
Reduction in Fringes	0.0%
Total Savings	-1.65%

The contract in effect at OCTD at the time of this analysis gave full fringe benefits to PTOs. Since FTOs and PTOs were entitled to the same health insurance benefits, the PTO fringe cost per hour was actually higher than the FTO cost. Thus the reduction in the number of FTOs was offset by the higher unit-fringe cost of the PTOs, resulting in no fringe-related cost savings.

The final step in assessing cost savings is to place them in the context of operating cost. It should be noted that we have dealt here with schedule-related costs, not total operator costs. Total operator cost includes the costs of providing unscheduled service, e.g. the extraboard. Because of the small number of PTOs employed in this case, it is reasonable to assume PTOs have no effect on unscheduled costs. Assuming that scheduled cost is 90% of operator cost, and operator cost is 50% of operating cost, the PTO cost saving for this agency amounts to only .82% of operating cost. But OCTD is hardly typical: its peak/base ratio is 1.2, and its PTO fringe benefits are unusually generous. On the other hand, we have ignored additional costs associated with higher PTO attrition. That is, these estimates assume that PTO and FTO attrition rates are the same.

TRI-MET had made its own estimate of cost differences in order to develop a strategy for dealing with an expected service reduction some years after they began

using PTOs. Cutting the schedule with and without PTOs directly gives payhours, platform hours, and number of regular runs. The schedule with PTOs requires 2.6% fewer pay hours. Wage related savings are estimated by applying average wage rates to regular hours, overtime hours, and part-time hours for each schedule. Table 2-5 shows that the daily scheduled wage cost with PTOs is 5.8% lower. Fringe cost factors are estimated on an annual basis from payroll data. TRI-MET includes the absence-related extraboard cost in the fringe calculation.

TABLE 2-5
IMPACT OF PTOs ON SERVICE COST AT TRI-MET

Category	Percent Change
Reduction in Pay Hours	- 2.6%
Reduction in Average Wage	- 0.9%
Reduction in Fringes	- 2.3%
Total Savings	- 5.8%

The difference in fringe cost contributes a 2.3% savings. Thus the total daily wage and fringe cost difference is 5.8%. On annualized basis this savings amounts to $1.55 million, or 2.5% of total operating cost.

TRI-MET's estimate of cost savings is based on the assumptions that the full complement of PTOs could be used, and the extra FTOs could be laid off. In fact, the contract prohibits FTOs being laid off before PTOs; though in this instance an ambitious early retirement program made it possible to keep most of the PTOs.

It should be noted that TRI-MET's cost-savings estimate represents an upper bound: all possible cost savings are included. Should the full complement of PTOs not be reached (due, for example, to high attrition rates), FTOs would have to cover PT runs at significantly higher cost. Our case studies indicated that this is frequently the case, as will be further discussed below. Should average PTO tenure increase, the PTO wage rate would approach the FTO rates. Savings related to the extraboard are particularly uncertain, because they assume that the size of the extraboard will respond to relatively minor changes in coverage requirements.

Finally, notice that more than half the total savings from PTLI (3.2% out of 5.8%) are attributed to the lower wages and fringes of PTOs, and this portion of the savings is less permanent. The lower effective wage of PTOs may disappear if the

PTO force acquires seniority; and there is already a trend toward higher PTO fringe benefits at many transit agencies.

Constraints on PTO Utilization

In practice, a variety of constraints operate to prevent a transit agency from hiring as many PTOs as are permitted by its contract. For example, PTOs are often restricted to runs which begin and end at a bus depot, whereas full-time operators can be relieved "on the road," without taking the bus out of service. In addition, there is almost always a maximum allowable time limit for part-time runs, and there is sometimes a minimum -- pieces of work smaller than the minimum are reserved as biddable overtime for full-time operators. Another common provision is that the number, or proportion of PTOs must be same at each division. Since the service profile usually differs between divisions, this provision limits the total proportion of operators to the number that can be used in the division with the least peaky schedule. Two case study agencies also have a provision which prohibits the splitting-up of two-piece runs in order to create part-time work. (In practice, though, this provision is unenforceable, because it is almost impossible to retain the identity of specific runs over several runcuts.)

Contract provisions like these tend to reduce the potential efficiency gains from use of PTOs. Transit managers who have been involved in the contract bargaining process acknowledged that the full impact of such provisions is difficult to anticipate, hence savings from PTOs are often much lower than had been anticipated. When subsequent contracts come up for renewal, these unanticipated restrictions then become the focal points for bargaining.

Even when contract provisions do not limit the use of PTOs below the percentage allowed, some agencies are unable to keep the PTO positions filled. High turnover rates and service expansion (hence transfer of PTOs to full-time status) were identified as factors by the case study agencies. In view of these issues, it seems prudent to discount estimates of PTO cost savings, or to estimate a lower bound "worst case" when considering PTO utilization issues.

WHAT DOES IT COST TO GET PART-TIME OPERATORS?

A central issue in this research is the cost, in general terms, of winning the right to use PTOs. In view of staunch union opposition, it would be anticipated that management must give up something in trade for the right to use PTOs. Moreover,

given that transit managers expected to reap large cost savings from PTLI, they were perhaps inclined to yield significant concessions.

How do we measure the cost of obtaining PTOs? We cannot just ask management what it cost: people are rarely objective when discussing the true cost of their "bargains." And the cost question is fundamentally difficult to answer in any event: it involves a guess about what else might have been bargained for if management had not focused its attention on PTOs -- the opportunity cost of bargaining for PTOs -- and what other kinds of concessions these things might have involved.

Furthermore, we have noted that most transit agencies alter their schedules after PTLI. Since the before/after conditions are not clear, it is very difficult to calculate the costs of any work-rule concessions. Suppose we observe that wages in the new contract (the one with PTOs) rose by 10%. Is that a large or small increase? The answer depends on what kinds of wage bargains other transit agencies were making that year, as well as a host of specialized, agency-specific factors, (e.g., was the prior settlement perceived as unusually low, hence labor is "owed one") or was the local political climate such that the transit agency wanted to avoid a strike?

We also want to know about the long-term effects of PTLI. Are the bargaining concessions made in the initial PTLI contract continued, and are further concessions made in subsequent contracts?

To answer these questions, we need a methodology that standardizes for all of the possible influences on the wage bargain, and also measures the size of the bargaining concessions over time. Our approach is to compare the average level of wages and fringes for a group of transit agencies with PTLI to the average level for a group of agencies without PTLI. We expect the averaging process to even out any idiosyncratic factors in the bargaining process. We can also explicity standardize some of the other factors which affect wage bargains through the use of a model that takes their influence into account and holds it constant.

A MODEL OF THE BARGAINING PROCESS

Bargaining concessions which might be exchanged for the right to use PTOs can take three forms: wage increases, benefit increases, and work-rule changes in favor of operators. Wage increases include increased salary for full-time operators, or a decrease in the number of years to get to the highest salary. Fringe benefits

concessions include increased sick days, holidays, or vacation days, more sick benefits, increased retirement pay, or larger employer insurance contributions. Work rule concessions might include decreasing the threshold for earning spread premium, or reducing the maximum spread time.

It is easy to place a monetary value on wage or benefit concessions, so it will be straightforward to use either of them as the dependent variable in our model. Work rule concessions are much harder to evaluate because any change in the schedule will also change the apparent value of the items in this catagory. For example, suppose management gives up a lower spread threshold in exchange for PTLI, but then recuts the schedule to reduce the opportunities for earning spread premium. The result might be no change in spread premium pay.

It seems reasonable to believe that the full-time operators will keep the bargaining focused on here-and-now salary questions, wages and fringes, because any change there produces easily calculable, relatively immediate benefits. The effect of wage and fringe increases can be calculated by everyone, and they benefit everyone, whereas the benefit of work rule changes is hard to anticipate. The effect of a spread rule concession is uncertain when the schedule is subject to change, and in any case such concessions affect only a minority of the operators.

Thus, any compensating give-backs that management trades to gain PTOs are likely to be in the categories which we can easily quantify and evaluate: wages and fringe benefits. How can we tell if management has given a wage increase in return for PTOs? Suppose we have current salary data for a large group of transit agencies with PTOs and a large group without PTOs. Suppose also that we compute the average wage in each group and discover that the PTO-agencies have higher wage rates. Before we can conclude that the wage differential resulted from the adoption of PTOs, we would want to be sure the two groups of agencies are similar in other respects. For example, we know that wages are higher in large transit agencies[15], so we would want to standardize for size differences between the two groups of agencies. The easiest way to do this is with the use of multiple regression. We fit the equation:

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[15]E.K. Morlok & S.E. Krouk (1983). Variations in driver wage rates and opportunities for transport cost reduction. Proceedings of the Transportation Research Forum, 24(1), 108-115.

Wage Rate = F(agency size, regional wage rate, PTO dummy variable)

where:

Wage Rate = wage rate of full-time operators;

Agency Size = number of vehicles;

Regional Wage Rate = the average wage rate, in that region of the country, for comparable work;

PTO Dummy Variable = 1 for agencies with PTOs, 0 for others.

The "number of vehicles" variable standardizes for any size-dependent effects, and the "regional wage rate" variable standardizes for the differences in working environments across cities. In effect, we hold constant the effects of agency size and local conditions on transit wages, and then ask whether the PTO dummy variable adds any significant explanatory power to the model.

In addition to salary increases, management can also trade fringe benefit increases when it is negotiating to obtain PTLI. Thus we also need to create a measure of fringe benefits to use as the dependent variable in our regression model. Since it is difficult to put a monetary value on retirement and health benefits, we concentrated on the three other components of the fringe benefit package: days of paid vacation, days of paid holiday, and days of allowable paid sick leave. We will combine these into a single variable, but it cannot be done as a simple, unweighted sum because the three components are not all equally important to labor. An extra day of allowable sick leave is not worth as much as an extra day of vacation or holiday: operators use all their vacation and holiday time, but they don't use up all their sick leave. For example, at CCCTA, the operators only use about a third of their allowable sick pay. Hence, when we operationalize the fringe benefit variable, we will use a weighted average of the three components: holidays + vacation + a fraction of allowable sick pay. The procedure for determining that fraction is discussed below.

Data for Analysis

Our sample consists of cross-sectional data for FY 1982 for 41 U.S. transit agencies. The sample was chosen on the basis of two criteria: length of experience with PTOs and data availability. The initial data source was the APTA Labor Practices Summary sheets. This was supplemented by UMTA Section 15 data, and by extensive calls and letters to each agency to obtain necessary additional data. We selected FY 1982 as our sample year because after 1982 almost all agencies had

won the right to use PTOs and consequently there would be no variance in the sample. If we went back much earlier than 1981-82, there would not have been enough agencies with PTOs. Finally, 1982 is five years after the starting point of the modern trend toward PTLI (the Seattle 1977 contract), and this permits us to follow many of the agencies through two successive contracts.

Table 2-6 shows the means for the entire sample. Table 2-7 shows the simple correlations between the sample variables. Simple correlation coefficients measure the strength of a linear relationship between the variables. The higher the number (either positive or negative), the greater the association between the two variables. Tables 2-8 and 2-9 show the means for the agencies with and without PTOs to permit comparisons of the subpopulations. It is apparent that there is considerable variation in the sample: agency size varies over about a thirty to one range, regional wage varies over about a two to one range, and peak/base ratio varies from 1.0 to 3.25.

Operationalizing the Variables

To measure the variety of possible management bargaining concessions, we construct three dependent variables: a measure of wages, a measure of fringes, and a measure which combines the two. This procedure is explained below.

To measure wage rate, we use the "top wage" for operators at each agency, since operators reach this wage relatively quickly. Operationalization of the fringe

TABLE 2-6
MEANS OF WHOLE SAMPLE (41 Cases)

Variable	Mean	Std Dev* (%Mean)	Min. Value	Max. Value	Definition of Variable
Veh.	355	100.	28	1142	# of vehicles during peak
Veh**2	2.2E+05	160.	784	1.3E+06	# of veh. squared
RegWge	8.45	15.	5.65	11.15	Regional wage rate
PT	.463	109.	0	1	=1 if PTLI; else =0
P/B	1.98	33.	1.00	3.25	Peak/base ratio
Wage	9.294	16.	6.70	12.01	Top operator wage rate
Spread	11.61	13.	10.0	16.0	Spread premium threshhold
PT:1-2	.3171	149.	0	1	PT in 1st/2nd year=1, else=0
PT:3-4	.1463	245.	0	1	PT in 3rd/4th year=1, else=0
Fringe	21.51	10.	15.40	27.20	Holiday+vacation+.2(sicks)
TotSal	10.07	16.	7.20	13.09	Total salary: wages+fringes

*Standard deviation divided by the mean.

TABLE 2-7
CORRELATION MATRIX FOR WHOLE SAMPLE (41 Cases)

Variable ID											
Veh	1.00										
Veh**2	.96	1.00									
RegWge	.37	.38	1.00								
PT	.38	.40	.10	1.00							
P/B	.29	.24	.28	-.06	1.00						
Wage	.75	.68	.48	.36	.21	1.00					
Spread	-.48	-.41	-.17	-.22	-.32	-.48	1.00				
PT:1-2	-.02	-.04	-.10	.73	-.21	.07	-.09	1.00			
PT:3-4	.55	.62	.28	.45	.18	.41	-.20	-.28	1.00		
Fringe	.53	.44	.23	.43	.10	.49	-.30	.32	.19	1.00	
TotSal	.75	.68	.48	.37	.21	1.00	-.48	.09	.41	.52	1.00
	Veh	Veh**2	RegWge	PT	P/B	Wage	Spread	PT:1-2	PT:3-4	Fringe	TotSal

TABLE 2-8
MEANS FOR AGENCIES WITH PTOs (19 CASES)

Variable	Mean	Std Dev (%Mean)	Minimum Value	Maximum Value
Veh	469.2	85.	28	1142
Veh**2	.37E+06	120.	784	.13E+07
RegWge	8.597	19.	5.650	11.15
PT	1	0.	1	1
P/B	1.937	33.	1.150	3.250
Wage	9.848	17.	7.01	12.01
Spread	11.26	13.	10	16
PT:1-2	.6842	70.	0	1
PT:3-4	.3158	151.	0	1
Fringe	22.48	9.	19.00	27.20
TotSal	10.71	17.	7.555	13.09

TABLE 2-9
MEANS FOR AGENCIES WITHOUT PTOs (22 Cases)

Variable	Mean	Std Dev (%Mean)	Minimum Value	Maximum Value
Veh	220	98.	30	885
Veh**2	.92E+05	192.	900.0	.78E+06
RegWge	8.329	12.	6.520	10.01
PT	0	*.	0	0
P/B	2.018	33.	1.000	2.920
Wage	8.815	12.	6.70	10.71
Spread	11.91	13.	10.5	16
PT:1-2	0	*.	0	0
PT:3-4	0	*.	0	0
Fringe	20.66	9.	15.40	24.40
TotSal	9.518	12.	7.200	11.54

benefit variable is more complicated. We use two different empirical approaches to construct a measure of fringe benefits: (1) inference from detailed analysis of the experience of a single agency; (2) a goodness of fit criterion. Fortunately, the results of the two approaches are consistent.

We use absence data from CCCTA to estimate the subjective value of different kinds of fringe benefits. At this agency, the operators use about a third of their available sick pay. However this does not necessarily imply that they value an extra day of allowable sick pay (from a bargaining concession) at one-third of a vacation day. How do we infer labor's value for an additional sick day? Our analysis of sick rates, in Chapter Three, shows that sick rates rise only about half as much as the increase in allowable paid sick days. That is, when management awards, say, a six day increase in allowable paid sick days, the sick rate subsequently rises by only three days per year. Furthermore, the three day increase in sick rates is not a three day increase in sick pay. Few transit agencies pay for the first day of sickness; most only begin paying on the second or third day of an illness. For example, CCCTA begins paying on the third day of an illness, and allows up to 12 paid sick days per year for senior operators. In the first nine months of 1984 these operators received 152 paid sick days out of 329 days of illness, i.e. they were paid for 46% of the days they were sick.

Combining these two conclusions, i.e., "sick rates go up about half as fast as the increase in allowable sick days" and "roughly half of absent-days will be paid days", we get an overall rate of about one-quarter. That is, a four-day increase in allowable sick pay will cost management only a one-day increase in actual pay.

Thus, we would expect that operators would value an increase in allowable sick pay only about one-quarter as much as an increase in holidays or vacations.

The previous estimate is based on analysis of a single transit agency. The next estimate is based on goodness of fit, and looks at the revealed preference of labor unions across a sample of 41 agencies. It uses a kind of maximum likelihood principle to determine the proper weight for the "sick days" term in the fringe benefit variable. We begin by constructing a number of alternative forms of the fringe benefit variable, and then determine which produces the best fit when used in the model. Since we are trying to infer labor's behavioral value for this fringe benefit, the correct value of the fraction will fit better than an incorrect value. We construct the following alternative variables:

Holidays + Vacation Days + 0.1 x Allowable Paid Sick Days

Holidays + Vacation Days + 0.2 x Allowable Paid Sick Days

Holidays + Vacation Days + 0.3 x Allowable Paid Sick Days

Holidays + Vacation Days + 0.4 x Allowable Paid Sick Days, etc.

We use these alternative forms in the regression model to see which one fits the best (highest R^2). Our estimations show that weights in the range of .2 - .3 are much better than weights outside that range, and a value of about .2 is the most consistent winner.

This fitted value is consistent with the .25 value derived from our analysis of actual sick leave patterns in CCCTA. Hence in the rest of the analysis we define fringe benefits as the sum of holidays + vacation + .2 x allowable paid sick days, and we base our Total Compensation variable on the sum of wages and this measure of fringes.

The data contain two measures of vacations: number of days earned after two years of experience, and number of days earned after five years of experience. To decide which measure is behaviorally correct, we again use the technique of creating alterative formulations and using the one which best explains the behavior measured by the independent variable. We select the two-year vacation figure since it gives the best fit. The data are for 1981-82, following a period of significant expansion in the transit industry. It is reasonable to suppose that most operators had less than five years of experience, and hence were concerned with the two-year figure.

Independent variables for the regression include measures of size, regional wage, and the part-time dummies. Agency size is measured by the number of

weekday peak service vehicles. To allow for nonlinearities in the relationship between size and the dependent variable, we included both vehicles and $(\text{vehicles})^2$ in the regressions. Local wage conditions are measured by the 1982 manufacturing wage. In the intial regressions, PTLI was modeled as a simple dummy variable. As Table 2-6 indicated, a little less than half the sample had PTOs.

Table 2-10 shows the initial regression results. Looking first at equation (1), with fringe benefits as the dependent variable, the Size variable is significant and non-linear: fringe benefits increase as agencies become larger, but they increase at

TABLE 2-10
INITIAL REGRESSION RESULTS

Dep. Var.	# of Veh.*	# of Veh. Squared	Reg. Wage Rate	PTO Dummy	Const.	R-Sq.	Eq. #
Fringe Benefits	8.49 (3.0)	-6.00 (2.2)	.129 (.6)	1.35 (2.3)	18.3	.354	1
Wage Rate	5.10 (3.3)	-2.47 (1.7)	.291 (2.4)	.373 (1.2)	5.50	.602	2
Wage + Fringes	5.82 (3.5)	-2.88 (1.8)	.323 (2.5)	.457 (1.3)	5.81	.620	3

* Vehicles are measured in thousands.
R-Squared is corrected for degrees of freedom
t-ratios in ( )

a decreasing rate. The regional wage rate variable is not significant, i.e. fringe benefit levels do not vary as a function of regional wage differences. The PTO dummy is significant and indicates that management gave up 1.35 extra days of fringes to obtain the right to use part-time labor.

Equation (2) shows the same pattern of increase between the dependent variable (operator wage rate) and the size variable. Regional wage rates are a significant determinant of the transit wage rate, as would be expected. The PTO dummy is positive, but is not statistically significant.

In Equation (3) we convert the fringe benefits to a dollar value, then add them to wages to get a Total Compensation variable. The conversion is made by multiplying the fringe variable by the daily wage rate. We find the familiar pattern between the dependent variable and agency size. Regional wage is significant, and the PTO dummy is in the expected direction but is not statistically significant.

Overall, the model explains more than 60% of the variation in wages (very good for a model of this type), and about 35% of the variation in fringes.

In Table 2-11 we modify the form of the regression model. First, we remove the regional wage variable from the fringe benefit model since there was no a priori reason to support it, and it did not prove significant. Second, we use an alternative form of the PTO dummy variable. These agencies have all had PTOs for four years or less, roughly two contract periods. We split the PTO dummy into the two separate variables: "obtained PTOs within the past 1-2 years," and "obtained PTOs within the past 3-4 years." This allows us to estimate the separate effects of labor concessions made during each of the first two contract periods following the

TABLE 2-11
DO THE WAGE GAINS PERSIST?

Dep. Var.	# of Veh.*	# of Veh. Squared	Reg. Wage Rate	PT Yrs 1 & 2	PT yrs 3 & 4	Const.	R-Sq.	Eq. #
Fringe Benefits	8.01 (2.8)	- 4.84 (1.7)		1.50 (2.5)	.487 (.5)	19.30	.365	4
Wage Rate	5.10 (3.2)	- 2.46 (1.6)	.291 (2.4)	.375 (1.1)	.362 (.6)	5.49	.590	5
Wage + Fringes	5.80 (3.4)	- 2.83 (1.7)	.324 (2.4)	.466 (1.3)	.415 (.7)	5.52	.609	6

* Vehicles are measured in thousands.
R-Squared is corrected for degrees of freedom
t-ratios in ( )

introduction of PTOs. Hence we can ask, does the level of concessions go up, down, or remain the same over time?

For the fringe benefit variable, equation (4), it appears that the initial increment in fringe benefits is not sustained into the second contract. For the wage and total-compensation variables, equations (5) and (6), the PTO dummies remain constant though they are not statistically significant.

Interpretation

Using the PTO coefficient of 1.5 in equation (4) and the average value of the fringe benefit variable, 22.48, we estimate that management gave up a 6% increase in fringes to gain the right to use PTOs. The PTO coefficients in equations (5) and

(6) are not significant at conventional levels, but they are both in the expected direction, and they are strikingly consistent over time. Using these coefficients we would conclude that management gave up a wage increase of 3.7%, and a total compensation increase of 4.1% to obtain the right to use PTOs. This would be our best estimate of the cost of bargaining for PTOs, and given the large standard errors on the regression coefficients, it is certainly not a very precise estimate. But based on these numbers, it appears that the contract concessions required to win PTOs are about the same size as what we now know to be the savings from PTOs. This is a startling conclusion, and requires further discussion. We take up, first, the question of biases in the analysis.

Possible Causes of Bias

We have run a number of multiple regression models on a cross-section of 41 transit agencies and discovered that, other things held equal, agencies with PTLI have higher fringes and salaries than agencies without PTLI. As with any cross-section regression, we should ask about the causal interpretation of the results. Our interpretation is the following: management's effort to win PTLI produces higher wages and fringes. But suppose causality runs in the other direction: agencies with high labor cost are the ones which seek PTLI, hence the significance of the PT dummy is spurious.

The counter-casuality argument says that the agencies with the greatest need for PTLI are the ones which bargain for it. An agency might need PTLI because of low schedule efficiency, or because of high wage rates. We know from the Chomitz and Lave analysis that the best predictors of schedule efficiency are spread rules and peak/base ratio. Hence, the agencies with the most incentive to bargain for PTLI are ones with tight spread rules and high peak/base ratios. If the counter-causality argument is correct than we should observe a high correlation between the PTLI dummy and these two factors. But the correlation between PTLI and peak/base ratio is -.06, and the correlation between PTLI and spread time is -.22; which are hardly impressive support for the counter-causality hypothesis.

An alternative way to test these ideas is to model the PTLI decision process. We ran a regression similar to those in Tables 2-9 and 2-10, but used the PTLI dummy as the dependent variable, with the following result,

$$PTLI = .504 - .144P/B - .0344Sprd + .066Wage - .412Veh + .762Veh^2$$
$$\quad (1.1) \quad (.6) \quad (.8) \quad (.4) \quad (1.0)$$

R^2=.097 t-ratios in ( )

Where: P/B = peak/base ratio

Sprd = spread premium threshhold

Wage = operator wage

Veh = peak vehicles

The results indicate that neither schedule efficiency factors (P/B & Sprd), nor labor cost (Wage), nor agency size (Veh & Veh^2) are significant predictors of which agencies have PTLI. Moreover, eliminating the size terms leaves this conclusion unchanged.

Summary

Our estimates show that management gave up a fringe benefit increase of 6% to obtain PTLI, but it is not clear if this gain persisted into subsequent contracts. We also estimate a wage increase of about 3.7% to obtain PTLI, and that this increase does persist into the second contract. But the confidence interval around this estimate is quite large, and it is even possible that there was no increase at all.

We also examined the possibility that our results come from a causality opposite to that of our hypothesis -- that high need agencies sought PTLI, producing a spurious correlation between the PTLI dummy and wages. There was no statistical support for the counter-causality hypothesis.

CHAPTER THREE

ABSENTEEISM, ACCIDENTS, AND ATTRITION

INTRODUCTION

When the use of part-time labor was first proposed, one of the principal concerns was whether part-time operators would be as committed and reliable as full-time operators. This chapter examines a number of these concerns and concludes that in general PTOs are dedicated, competent employees whose performance is usually as good as, or better than, that of the full-time operators.

We also examine the effects of PTLI (part-time labor implementation) on the full-time operators. We find that PTLI has reduced spread premium pay and overtime pay for some FTOs. But, of course this is offset by the better quality FTO runs which result. Finally, we discuss two new uses of the PTO concept that would benefit all the interest groups: 1) Allowing PTOs to work weekends would give PTOs the extra pay they want, and would give FTOs the free weekends that they want. 2) Allowing FTOs to do an occasional, temporary stint of part-time work will broaden their range of choices, and will open up extra pay opportunities for PTOs.

COMPARATIVE ABSENTEEISM: PTOs VERSUS FTOs

This analysis concentrates on absenteeism resulting from sickness, though there are some data on injuries as well.

Table 3-1 shows comparative sick rates, PTO vs FTO, for all five of our case study agencies. The rates are computed as percentage of work days per year when an operator calls in sick. The FTO sick rate exceeds the PTO rate at every agency and, on average, it is 2.3 times higher. These agencies represent a considerable range of sick leave policies: the number of paid sick days per year varies from 0 to 12; the degree of enforcement on required doctor's certificates varies considerably; one agency begins paying sick pay on the first day of illness, other agencies do not begin payments until the third day; and policies on accrual of unused sick leave vary considerably as well. We use these inter-agency variations to explore the reasons why PTOs have lower sick rates.

TABLE 3-1

COMPARATIVE SICK RATES, PTOs AND FTOs

Yearly Cross-Section Data, with Nothing Held Constant,

i.e., Varying Amounts of Fringe Benefits and Sick Pay.

	Seattle METRO	OCTD	SEMTA	TRI-MET	CCCTA
FTO Sick Rate*	3.75%	3.52%	2.31%	4.29%	4.02%
PTO Sick Rate	1.41%	1.71%	1.02%	1.59%	1.60%

*Proportion of yearly work days an operator will call-in sick.
SEMTA is an unreliably small sample.

"Differences in Sick Pay" as the Explanatory Factor

The customary explanation for the lower sick rate of PTOs is that PTOs do not receive sick pay, hence they cannot afford to be sick. Two of our agencies, OCTD and CCCTA, provide examples where PTOs and FTOs receive identical sick benefits. If the customary explanation is correct, and sick pay differences are the important causal factor, then we would expect that PTO and FTO sick rates would be nearly identical.

At CCCTA, FTOs receive no paid sick leave during their first year, and PTOs never receive sick pay. These groups allow a natural comparison because both groups of operators are relatively new to the job, and both should have similar concerns about acquiring good work records. (The PTOs are on informal probation, because most of them want to be chosen, eventually, for full-time work. The FTOs are in their first year of work and hence are on formal probation for almost all of the period covered in this data.)

Table 3-2 shows their comparative sick and injury rates. The rates are expressed as percentage of work days when the operators call in sick. Four different rates are reported. Rate "SI" is based on total sick and injured days; rate "S" is based on sick days only. In small samples like this, the presence of a few random instances of major illness can substantially bias the apparent rate. Hence, rate "S40" excludes any operator who was sick more than 40 days (8 weeks); and rate "S30" excludes any operator who was sick for more than 6 weeks. (Neither "S40" or "S30" screening ever excludes more than 10% of the sample.) Proof that the "S40"

and "S30" rates do standardize against random events can be seen by comparing the "SI" rates for PTOs against the "S40" rates: the "SI" rates vary by almost two to one, the "S40" rates are very close to each other.

TABLE 3-2

COMPARISON OF FULL-TIME OPERATORS WITH 0 SICK PAY

TO PART-TIME OPERATORS WITH 0 SICK PAY

	"SI"* [Sick + Injured]	"S" [Sick Only]	"S40" [No Sicks >40 Days]	"S30" [No Sicks >30 Days]	# of** Ops.
FULL TIME WITH 0 SICK PAY					
Hired in 1982, 1983 Data	5.87%	3.92%	3.56%	3.03%	18
Hired in 1983, 1984 Data	5.61	3.27	3.27	2.39	18
PART-TIME WITH 0 SICK PAY					
Hired in 1982, 1983 Data	1.67	1.67	1.67	1.67	18
Hired in 1983, 1983 Data	2.93	2.93	1.64	1.64	41
Hired in 1983, 1984 Data	2.36	2.36	1.52	1.52	23
Hired in 1984, 1984 Data	2.93	2.93	1.58	1.58	33

*Proportion of yearly work days.

Regardless of which definition we use, the CCCTA data show that PTO sick rates and injury rates are lower than FTO rates, even when both groups of operators have identical sick pay benefits. Something other than sick pay is making an important difference between PTO and FTO sick rates.

OCTD provides another instance where PTOs and FTOs have identical sick benefits. It has a class of PTOs who receive 12 days per year of allowable sick pay, which is identical to the sick benefits of their FTOs. Table 3-3 shows comparative sick rates (using the "S30" rate definition discussed above) for PTOs and FTOs, and again, despite the fact of identical sick benefits, the PTO rate is lower.

Tables 3-2 and 3-3 both involve cross-sectional data: they look at two samples of operators, at a single point in time, under the implicit assumption that the only thing different between the two samples is their PT/FT status. Obviously, such an assumption may not be correct in general, but OCTD provides a chance to validate it. OCTD allows one particular group of operators to switch back and forth between full-time and part-time status, while maintaining full sick leave benefits. (Some

FTOs choose to switch to part-time status during the summer, or to have a period of lighter duties, etc.) By examining the absentee records of these operators we are holding constant both sick benefits and any possible variation in personalities (which might conceivably be related to PTO/FTO status). Table 3-4 shows the results, and again we see that there is a lower sick rate associated with part-time work.

TABLE 3-3
PART-TIME OPERATORS HAVE LOWER ABSENTEEISM THAN FULL TIME OPERATORS WHEN BOTH RECEIVE 12 DAYS PAID SICK LEAVE PER YEAR.

	FTOs With Sick Pay	PTOs With Sick Pay
Reported Sick Rate (w/o Sick > 40 Days)	3.52%	2.44%

We do not conclude that sick pay makes no difference in absenteeism (indeed, a later section shows that increased sick pay does cause increased absenteeism), but rather we are saying that any effects of sick pay are not sufficient to explain the difference in absenteeism between PTOs and FTOs.

TABLE 3-4
THERE IS A DECLINE IN ABSENTEEISM FOR FT OPERATORS WHEN THEY MOVE FROM FT-RUNS TO PT-RUNS

	Sick Rate While On FT-Runs	Sick Rate While On PT-Runs
Reported Sick Rate (w/o Sick > 40 Days)	4.50%	2.44%

The Effect of Probation on the Sick Rate

Probation is another factor which has often been cited as an explanation for the low PTO sick rate. Probation tends to keep operators on their best behavior, and PTOs spend a much higher proportion of their career in that status. The PTO probation period is often the same number of hours as the FTO probation period, but given their lower hours/day, PTOs spend more calendar days on probabation, e.g. for a typical 1040 hour probation period, an FTO would be off probation in six months, but a PTO averaging 4 hours/day would be on for an entire year.

To measure the effects of probation we took cohorts of PTOs and FTOs who had both begun work about the same time (roughly 1980), and examined their absentee

records for a period approximately three years later. The PTOs would be long past probation at this point, and both cohorts would have similar clock-time on the job. Each cohort contained approximately three hundred operators.

For each cohort we examined absentee records from June 1982 to June 1983. In each case we added together days sick plus days on worker's compensation. The absence rate for the PTOs was 0.067, and the rate for FTOs was .160, so the FTOs were absent about 2.4 times more often than the PTOs. That is, for matched groups of operators all well past their probation periods, the FTOs were absent more than twice as often as the PTOs.

We also compared the absenteeism of this PTO cohort to the absenteeism of the total PTO population, most of whom have been hired more recently and hence are still on probation. The absentee rate for the total PTO group was .043, compared to the .067 rate for the older PTO cohort. That is, the older cohort is about 50% more likely to be absent. Thus we conclude that probationary status does reduce absenteeism, but it is nowhere near a large enough factor to explain the general difference in absentee rates between PTOs and FTOs.

The Regularity of the PTO Baseline Sick Rate

One interesting sidelight on the PTO sick rates is their apparent consistency between transit agencies. We have good data on absenteeism from four agencies (the sample from SEMTA is only twenty observations, which is too small to use for comparative purposes), and all have PTO sick rates of about 4 days per year. (See Table 3-5). At CCCTA, this rate holds up for two separate years of data; the data for Seattle METRO, OCTD, and TRI-MET are for a single year's sample. What the four agencies have in common is their lack of paid sick leave for PTOs, but they differ on everything else -- degree of supervision, attention placed on absenteeism, and so on. Pending additional work, it is probably best to regard the commonly observed 4-day sick rate as an interesting coincidence.

Some Speculative Guidance for Future Research

We have observed that there is something inherent in part-time work assignments that produces lower sick rates. Why might this be true? We offer three possible explanations as a possible starting point for future research.

TABLE 3-5
NUMBER OF DAYS SICK PER YEAR FOR PART-TIME OPERATORS.
(Yearly Cross-Section Data from Agencies with Large Samples)

	Seattle METRO	OCTD	TRI-MET	CCCTA
Observed PTO Sick Days/Year	3.6 days	4.4 days	4.1 days	4.1 days

HYPOTHESIS 1: PTOs CANNOT AFFORD TO BE ABSENT. Part-time assignments produce barely enough money to live on, hence PTOs have a very high incentive to show up for work. (Even in those agencies where PTOs do get sick pay, they don't get it on the first day of absence.) If this hypothesis were true, we would expect to find two effects: (1) the difference in sick rates between PTOs and FTOs will disappear at agencies where PTOs get sick pay on the first day; (2) the difference in sick rates will be larger at agencies with no sick pay.

HYPOTHESIS 2: IT IS EASIER TO WORK A SHORT ASSIGNMENT THAN A LONG ONE IF YOU ARE FEELING SICK. Hence, for any given degree of illness, an operator is more likely to report for work if he is facing an easy assignment. If this hypothesis were true, we might expect to find the PTO sick rate to move closer to the FTO rate at transit agencies where PTOs work two shifts a day.

HYPOTHESIS 3: PTO STATUS IS LIKE BEING ON PROBATION ALL THE TIME; PTOs TRY ESPECIALLY HARD TO ACQUIRE GOOD WORK RECORDS, BECAUSE MOST PTOs WANT TO BE PROMOTED TO FULL-TIME WORK. Although this seems a generally reasonable idea, remember, we even found a sick rate differential at OCTD, between FTOs and those PTOs who could switch to FT work as a matter of right, and hence were under no "probation" pressure.

PART-TIME VERSUS FULL TIME OPERATORS: OTHER ISSUES

Miss-Out Rates

Although illness and injury are the major catagories of absenteeism, there are other components as well. Miss-outs refer to situations where an operator misses a run because of showing up late, oversleeping, etc. Since the definition of miss-outs seems to vary among agencies, it is not valid to compare rates across agencies. However PTO versus FTO comparisons within a single agency should be valid. Table 3-6 summarizes the data across our five case study agencies. The results are decidely mixed. PTO miss-out rates are lower than FTO rates at OCTD and

TRI-MET (if we look at all the FTO catagories in TRI-MET); but they are higher at the three other agencies. In any event, the differences are quite small compared to the difference in sick rates between part-time and full-time operators. Thus, overall, if we were to form a kind of "reliability index" by combining the sick rate and the miss-out rate, it is still apparent that the PTOs are more reliable than the FTOs.

TABLE 3-6
COMPARATIVE MISS-OUT RATES, PTO VERSUS FTO
(I.E., 1.20%)

	Seattle METRO	OCTD	SEMTA	TRI-MET	CCCTA
Part-Time Operators	.55%	1.0%	1.20%	.66%	.67%
Full Time Operators	.35%	1.5%	.60%	.44%	.38%
FT Extra-Board	-	-	-	.86%	-
FT Regular Relief	-	-	-	.81%	-
FT Vacation Relief	-	-	-	1.07%	-

All figures are expressed as percentage of days per year.
For Seattle Metro, we combined "Late" & "Unexcused Absence"
The sample at SEMTA is too small, only 20 operators.

Allowing Operators to Switch From FTO to PTO Status

OCTD has just begun a unique innovation in the use of part-time labor. It does not save money for the transit agency, but it does provide a significant increase in the work options available to the operators. This agency's full-time operators bargained for the right to bid part-time work runs, for a given signup period. Those FTOs who go part-time retain their seniority and their full benefits: sick pay, holidays, vacations, leaves, etc. (Operators retain full health insurance, but pay for the other benefits in proportion to hours worked: for example, a regular operator, on temporary PTO status, with a 3 hour run would receive 3 hours of sick pay if he/she became sick.) But for the duration of that signup period, these operators work fewer hours and receive less total salary. At the end of the signup, they can return to full-time status or remain on PTO status for another signup. The FTOs wanted this as an option for situations such as a female FTO who wanted to spend more time with her children during the summer, an FTO suffering from "burnout" who wanted a period of reduced stress, a chronically ill operator who needed a period of reduced work to regain his/her health, and so on.

Thus the agency now has three classes of operators: regular operators who may switch back and forth between full-time status and type "A" part-time status; and type "B" part-time operators, who receive no sick benefits, and who may not bid for full-time status unless there are openings that the type "A" PTOs do not wish to fill. During the first year, 16 regular FTOs decided to try a stint as PTOs. Subsequently, 10 returned to FT status, and 6 elected to remain on PT status. Because they served in both PT and FT status during the year, Table 3-7 shows their records separately for the two kinds of work. The first two rows include all 16 operators; but five had unusually high sick or injury records (more than 40 days per year). The next two rows show the absentee records of the 11 operators with more typical sick rates.

TABLE 3-7
RECORD OF TYPE "A" PTOs

	Sickness	Miss-Out	Injury
All Data Included			
While Serving as FTO	8.90%	1.85%	4.58%
While Serving as PTO	9.92%	1.76%	.64%
W/O Major Sick/Inj.			
While Serving as FTO	4.50%	1.69%	.00%
While Serving as PTO	2.44%	2.07%	.98%

In our other agencies, the proportion of operators exceeding the 40 day criterion is usually less than 10%. Why should there be 5 out of 16 here? These 5 operators all had unusually high sick/injured rates before bidding for PTO status. We do not know whether they chose PTO status to ease their work burden, or whether they were informally pressured into it by management, though the fact that 2 of the 5 have returned to FT status suggests that the decision was by their own free choice.

Given the small size of the sample, and hence the way in which a single random instance of major illness or injury can affect the group average, it is probably best to concentrate on the last two rows, the rates which screen out the unusual incidents. The drop in sick rate from 4.50% to 2.44% following the move to PT status is quite interesting. Sick benefits are identical in the two statuses, so there is no economic reason which might explain the change. (Perhaps after the typical 8+ hours of the FTO, the 3+ hours of a typical PT shift seems so easy that a marginally sick operator will report for work anyway.) Miss-out rates do not change much, and

indeed they are quite similar to the FTO rates at this transit agency. There is an insignificant increase in the injury rate when operators move from FT to PT status.

It is also interesting to compare the records of those operators who chose to bid for PT status with those who did not. Table 3-8 summarizes the relevant data, and makes it clear that the operators who decided to try PT status had previously shown higher sick and injury rates than their colleagues. This is true whether comparing the total data in rows 1 and 2, or the screened data in row 3. Following the move to PT status their absenteeism fell by almost half, from 4.50% (row 3) down to 2.44% (row 4). That is, looking at the decision to bid PT status, the group that decided to move to PT status had previously been characterized by above-average absentee rates, but following the move to PT their rates improved to become better than the average.

TABLE 3-8
OPERATORS WHO BID PT VERSUS THOSE WHO DID NOT

	Operators Who Tried PT	Operators Who Did Not
All Data Included		
Sick Rate on FT Status	8.90%	6.09%
Injury Rate on FT Status	4.58%	3.58%
W/O Major Sick/Injury		
Sick Rate on FT Status	4.50%	3.52%
Sick Rate on PT Status	2.44%	n.a.

This agency provides an example of implementing part-time labor to benefit the operators. There are no direct cost savings for the transit agency; it may even be slightly more expensive. (The agency agreed to the new policy as a bargaining concession to labor, in return for the agency winning the right to create an unusually inexpensive class of PTOs -- one with lower wages and very few fringe benefits.) From the viewpoint of the existing full-time operators, the new policy is a major benefit which provides them with significantly more choices in their work lives.

The Effect of Irregular Work on Absenteeism

At TRI-MET we were able to produce absentee data broken down by type of work assignment: part-time, regular full-time run, and extra board. Table 3-9 shows the effect of work-type on absenteeism. The extra board operators have higher absenteeism in most of the catagories. We believe this results from their irregular

TABLE 3-9
THERE IS SOME TENDENCY FOR ABSENTEEISM TO INCREASE ON IRREGULAR WORK ASSIGNMENTS -- THOSE WHERE AN OPERATOR IS NOT EXPERIENCED ON THE PARTICULAR ROUTE

Absentee Catagory	Extra Board	Regular Run	P-T Run
Absent: Excused	2.25	1.26	1.51
Unexcused	.61	.17	.07
Sickness	9.10	11.15	4.13
Comp	8.88	6.32	6.10
Light Duty Sick	.19	.21	.00
Light Duty Comp	3.43	1.98	1.15
Oversleep	2.15	1.10	1.77
# of Driver-weeks of Data	9,244	30,958	5,554

(Figures are in Days per Year.)

work shifts -- the degree to which the operators have to deal with continually differing routes and times.

(When we analyze the accident data later in this chapter we find a similar relationship between work-irregularity and the accident rate. It is possible that the rise in accidents with work-irregularity occurs because the operator is unfamiliar with the route and is not able to devote full attention to basic driving. And it is possible that the rise in absenteeism with work-irregularity occurs because of the higher stress of the unfamiliar runs.)

INCREASES IN SICK PAY CAUSE INCREASES IN ABSENTEEISM

In a previous section, we found that differences in sick benefits, by themselves, were not sufficient to explain the differences in absenteeism between PTOs and FTOs. That does not mean that the sick benefit differences are unimportant. This section tries to measure the effects of paid sick leave on the observed sick rate.

At CCCTA, operators have no paid sick leave their first year, and receive higher amounts of paid leave as their careers advance. This allows us to examine the experience of a fixed cohort of operators as they acquire progressively higher benefit levels; that is, the operators remain the same while the sick benefits vary. Table 3-10 follows the sick rate behavior of two separate groups of operators over time. Cohort #1 begins with no paid sick leave their first year, and moves to 3 days of paid sick leave their second year: the result is an increase in the observed sick

rate. Cohort #2 is a more experienced group of operators, hired under an earlier, more generous contract. In 1983 they were entitled to an average of 5.2 paid days of sick leave apiece; in 1984 they were entitled to 12 paid days per year. The result was an increase in the observed sick rate.

TABLE 3-10
AS DRIVER-COHORTS OBTAIN MORE ALLOWABLE PAID SICK LEAVE, THEIR OBSERVED SICK RATE INCREASES

	1983 Sick Rate	1984 Sick Rate
COHORT NUMBER ONE		
Observed # of Sick Days	8.5 days	9.1 days
Allowable Sick Pay*	0 days	3.0 days
COHORT NUMBER TWO		
Observed # of Sick Days	10.5 days	13.5 days
Allowable Sick Pay	5.2 days	12.0 days

*Measured in days/year.

OCTD data offers cross-sectional evidence of the relation between absenteeism and sick pay. It has one class of PTOs who receive no sick pay and another class of PTOs who receive 12 days of allowable sick pay per year. Table 3-11 compares observed sick rates for the two groups of PTOs, and finds that the group with more sick benefits has a much higher sick rate. This result is true whether we compare using the Seattle METRO rate (all sicks and injuries), or the SEMTA rate (only sicks, and exclude operators with random, major sick episodes).

TABLE 3-11
PTOs WHO RECEIVE PAID SICK LEAVE HAVE HIGHER ABSENTEEISM THAN PTO's WHO DO NOT GET SICK PAY

	PTOs with 12 Days Paid Sick Leave	PTOs with 0 Days Paid Sick Leave
Major Sick Rate: Total Sick and Comp Incidents	9.92%	4.26%
Baseline Sick Rate: (- Sicks > 40 Days)	2.44%	1.48%

Cross-sectional data at CCCTA allow a somewhat more precise measurement of the effect of increasing sick benefits. CCCTA began with a provision for 12 paid sick days per year, but several years later began hiring new operators under a

provision where they were given only 3 paid days per year (which increases to 6 paid days as they acquire more seniority). Sick pay is earned the first calendar year of service, on a pro rata basis, and is then available for use during the second calendar year. Thus, because the existing operators were hired under two different sets of benefit rules, and because operators earn differing amounts of sick benefits for use during their second calendar year of service, this agency provides observations for FTOs with four different levels of paid sick leave: 0, 3, 5.2, and 12 days.

The first row of Table 3-12 shows the amount of paid sick leave allowed, and the second row shows the observed sick rates, measured as the ratio of sick days to total work days (using the average of the SEMTA and TRI-MET rates). The third row expresses the sick rate in terms of days per year. It is easy to see that increases in the observed sick rate go along with increases in allowable paid sick days.

TABLE 3-12
SUCCESSIVELY HIGHER AMOUNTS OF ALLOWABLE PAID SICK LEAVE ARE ASSOCIATED WITH WITH SUCCESSIVELY HIGHER AMOUNTS OF OBSERVED ABSENTEEISM

Number of Paid Sick Days Allowed	12 days	5.2 days	3 days	0 days
Observed Sick Rate (Yearly Pcntge)	5.27 %	4.05 %	3.50 %	2.99 %
Observed Sick Rate (Days per Year)	13.7 days	10.5 days	9.10 days	7.77 days
Observed Effect of Paid Sick Leave (Difference Between Adjacent Cols.)		3.2 days	1.4 days	1.3 days
Possible Effect of Paid Sick Leave		6.8 days	2.2 days	3.0 days
Observed Diff. Divided by Possible Diff.		47 %	63 %	43 %

The fourth row shows the difference in observed sick rates between adjacent columns. For example, when FTOs move from 5.2 allowable paid days per year to 12 allowable paid days per year, their observed sick rate increases by 3.2 days. The difference in allowable sick pay was 6.8 days (12 minus 5.2). Taking the ratio of observed-increase to allowable-increase, we see that the sick rate increased by about half of the increase in sick benefits. This same rate of increase is observed between the other columns as well. Looking at it in overall terms, when operators receive no sick pay they are sick 7.77 days/year; if they are allowed 12 paid

days/year, the 12-day increase in benefits brings about a 5.93 day increase in sick days. That is, the observed sick rate of full-time operators increases about half as fast as the increase in sick benefits.

MEASUREMENT AND CONTROL OF ABSENTEEISM

Measurement of Patterns of Absenteeism

At transit TRI-MET, we had detailed breakdowns of absenteeism data on a garage (division) by garage basis. This gave us the opportunity to search for patterns among garages. Normally, we would expect them to be alike over the course of the year: operators in all the garages are exposed to the same physical hazards (e.g., diseases, bad weather), and they were all exposed to the same temptations (e.g., holidays, hunting season); thus the change in the daily absentee rate should be more or less synchronized across the garages.

Figure 3-1 shows the Sick Rate at each garage, over the course of the year. The vertical axis is percentage times 1000; that is, 30 means 3% daily sick rate. The five trend lines are vaguely similar, though not as close as expected. We decided to see if the lack of similarity was caused by differences in supervisory practices among the garages.

Figure 3-2 adds together the Sick Rate plus the Excused Absence Rate, and plots the total over time. It is easy to see that the five trend lines now look more similar. It appears that the actual pattern of absentee behavior is the same at the five garages, but the manner in which the dispatchers record the absences is quite different. At some garages, when a driver calls in, the dispatcher will be more likely to record it as an Excused Absence; at other garages the dispatcher is more likely to record it as a Sick. Drivers are similar, but there is considerable variation in the permissiveness of supervisory personnel.

It is possible to use correlation coefficients to quantify these graphical patterns in a more formal way. If the operators at the different garages did have similar absentee patterns, then the correlation coefficient between any two garages would be relatively high. Table 3-13 shows the correlations between between the monthly pattern of Sick Rates at each pair of garages. The presence of all the coefficients in the .0-.2 range indicate that the similarity is not very high.

Table 3-14 shows the correlations for the new variable: the sum of the daily Sick Rate and the daily Excused Absence rate. Column 1 shows the intercorrelations between garages for this new variable, and column 2 shows the

FIGURE 3-1

SICK RATE

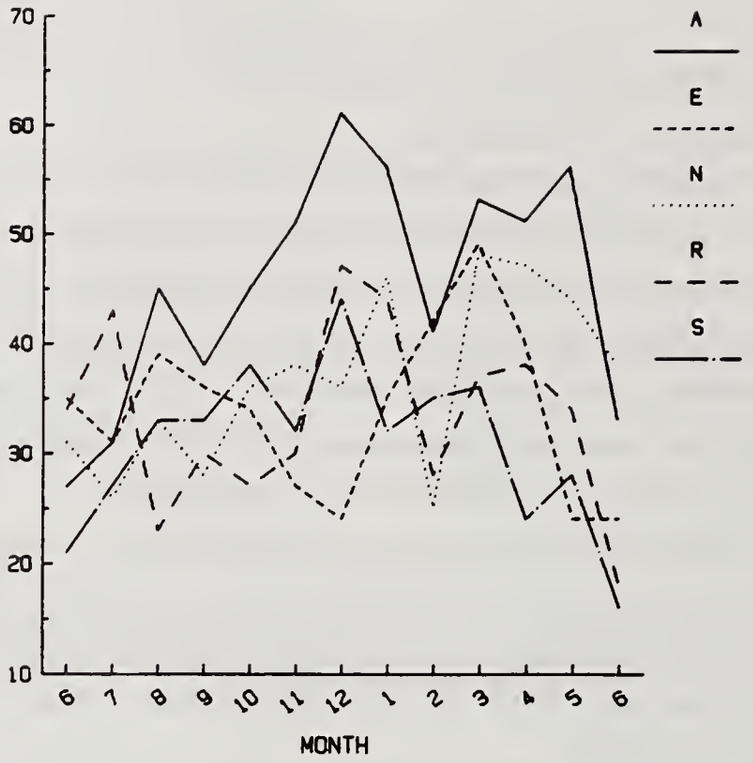

FIGURE 3-2

SICK AND EXCUSED

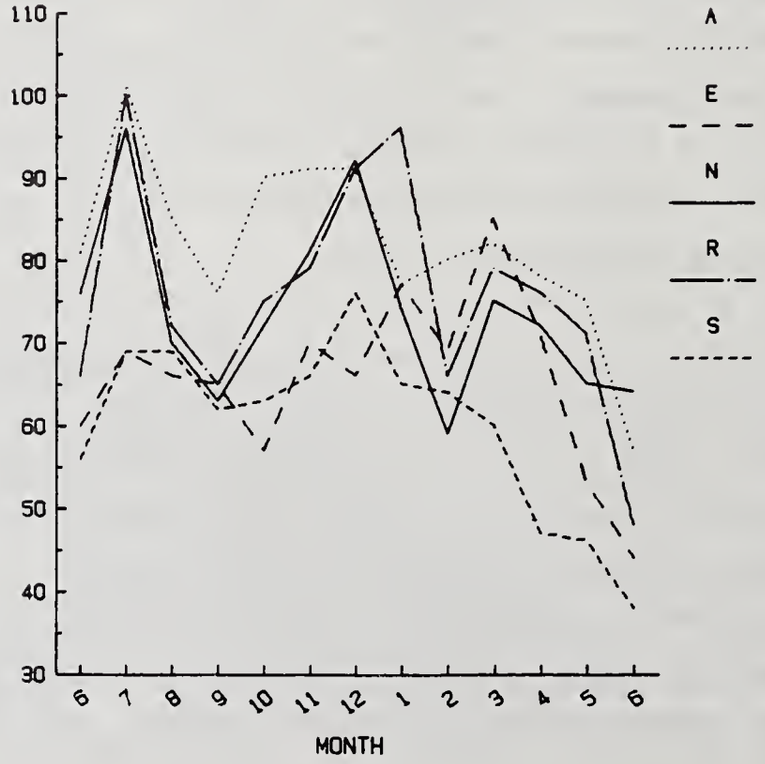

TABLE 3-13
CORRELATION OF SICK RATES ACROSS GARAGES

Garage A	1.00				
Garage E	-.04	1.00			
Garage N	.67	.06	1.00		
Garage R	.43	.00	.26	1.00	
Garage S	.59	.17	-.04	.33	1.00
	A	E	N	R	S

intercorrelations for the Sick Rate alone. The correlations in the left hand column are much larger than those in the right hand column. That is, the daily pattern of (Sick + Excused) is more similar across garages than the pattern of sicks alone.

TABLE 3-14
CORRELATION OF "SICK + EXCUSED" ACROSS GARAGES

	Sick + Excused	Sick Rate		Sick + Excused	Sick Rate
A with E	.44	-.04	E with R	.61	.00
A with N	.74	.67	E with S	.53	.17
A with R	.74	.43	N with R	.78	.26
A with S	.79	.59	N with S	.55	-.04
E with N	.31	.06	R with S	.66	.33

These results demonstrate why we have restricted our analysis to within-agency comparisons. That is, FTO/PTO comparisons are made for each agency, rather than comparing the FTOs at one agency with the PTOs at another. There is obviously a lot of measurement error in the sick rate data, if such large differences are observed between garages in a single agency.

Effect of a "No-Fault" Absentee Policy at OCTD

High absentee rates have become a growing concern at most transit agencies. The response at two of our case study agencies involved the formulation of a new philosophy concerning absenteeism. It says:

> All absences are the same because they are all equally costly to the agency. We are not concerned with issues of fault, or with the fact that a particular absence had a "good" cause. What matters is the end result, and operators who are unable to fulfill their duties consistently should find work in industries where reliability is not so critical.

The traditional discussion of absenteeism concentrated on why it happened and whether the operator was to blame or not. The new philosophy ignores such moral wrangling and concentrates on the occurrence itself. Thus, we have nicknamed this approach the "No-Fault" philosophy: if an operator is injury prone, chronically sick, or has habitual problems with conflicting obligations, then that operator is not capable of meeting the reliability needs of the transit industry.

OCTD implemented a new absenteeism policy based on this philosophy three years ago. It says:

> Fourteen Counted Absences per year are grounds for immediate dismissal. A Counted Absence is any kind of absence except for bereavement, jury duty, military duty or pre-approved leaves for personal business or union business. On long periods of illness, only the first two days are Counted Absences.
>
> If an operator has no miss-outs for 90 days, then all the old miss-outs are cleared from the record; there is no limit to the number of times an operator may do such record-clearing. If an operator has no Counted Absences for 120 days, then all the old Counted Absences are cleared from the record, but this may only be done once each year.

Did the new policy reduce absenteeism? We made a number of detailed comparisons. First, examining the two months prior to the new policy and the two months after the new policy took effect, absenteeism (i.e., the sum of sickness, injury, personal holidays, and leave) dropped from 11.9% to 10.1%: a 1.8% drop. To be certain this drop was not just the effect of seasonal variation, we computed an additional measure. Using seasonally-identical 25 week periods before and after the new policy (August 17 - February 7 in both years), we calculated an absenteeism rate of 11.2% for the period before the new policy and 9.4% for the period afterwards: a 1.7 percentage point drop. For these same two periods we also calculated the number of leaves and miss-outs and discovered that these were essentially unchanged; that is, the improvement in absenteeism was not offset by any corresponding increase in other categories.

Overall, the new policy is clearly a success and seems to have reduced absenteeism by 1.7-1.8 percentage points. To put this figure into perspective, we note that it is probably responsible for a larger cost saving than that resulting from the use of part-time labor at this agency.

COMPARISON OF ACCIDENT RATES BETWEEN PTOs AND FTOs

Table 3-15 shows comparative accident rates as a function of amount of experience. The number of accidents per year for FTOs declines with experience, and PTO accident rates are lower than those of FTOs. The table ablso breaks down the accidents into "chargable" and "non-chargable", where chargable accidents are those which the operator could have prevented.

TABLE 3-15
PTO ACCIDENT RATES ARE LOWER THAN FTO ACCIDENT RATES
(On a "Per Year" Basis, Driving Exposure is Not Standardized)

	FTO	FTO	FTO	FTO	PTO	PTO
Years of Experience	3.70	2.60	2.30	1.30	1.30	0.60
Accident Rate: Total	1.33	1.50	1.17	1.59	1.17	.95
Accid. Rate Chargeable	.49	.27	.34	.59	.58	.38
Accid. Rate Non-Chrgbl	.84	1.23	.83	1.00	.59	.57
Sample Size	9	28	18	18	23	33

(Accidents per year. Total of all vehicle and passenger incidents.)

Table 3-16 shows comparative accident rates at a different agency. This time the data are structured by the type of work assignment. The PTO accident rate is higher than that of FTOs who do regular runs, but lower or equal to that of regular operators who do relief runs or extraboard work. The table also breaks down the accidents by preventable/non- preventable. The PTOs are judged to have a higher

TABLE 3-16
PTO ACCIDENT RATES ARE WITHIN THE RANGE OF FTO ACCIDENT RATES
(On a "Per Year" Basis, Driving Exposure is Not Standardized)

	Extra Board	Regular Run	P-T Run
Accidents per Year	2.20	0.68	1.39

Potential "Reporting" Bias Against PTOs

	Extra Board	Regular Drivers	PTOs
% of Total Accidents Judged "Preventable"	45%	51%	60%

proportion of preventable accidents. This might be an indication that PTOs are worse operators, or that the operators who evaluate the accidents are biased against PTOs and hence more likely to decide that PTOs were at fault.

Tables 3-15 and 3-16 report on accidents per year. But this is not a wholly adequate statistic for judging the quality of the two operator groups. First, FTOs do more driving, and hence would be expected to have more accidents. Second, PTOs do more driving during the congested hours of the day, which might raise their accident rates. Third, FTOs have much more experience, which ought to lower their rate; and fourth, there may be substantial differences in the drivability of the vehicles used by the two groups -- size, age, etc. Ideally, the accident rates should be standardized for all of these different "exposure" factors. Attanucci and his colleagues[16] were able to standardize for exposure at the Boston MBTA, and found that PTOs had higher accident rates. However PTLI at Boston seems to have been a worst case situation in many respects, and even their accident situation has improved markedly since the initial period. Thus it is not clear that the Boston findings generalize to more normative transit agencies.

The data required to produce completely standardized accident records are quite extensive. For each accident one must have: (a) time of day, weekday vs. weekend, PTO vs. FTO; (b) driving experience of the operator; (c) daily platform time of that run; and then (d) data on all the operators with the same experience and status who did not have accidents. The (a), (b), and (c) data are stored in different files, maintained by different departments (Traffic Safety, Personnel, and Scheduling, respectively), and are often on different computers as well. We were only able to assemble a complete set of data files for transit Seattle METRO, and only for a ten month period, January-October. The remainder of the section is based on these data.

The gross, unstandardized accident rates at Seattle METRO are: PTOs = .529 accidents per operator; FTOs = .930 accidents per operator. But these need to be adjusted for all the different exposure factors. We begin by looking at the effect of time-of-day on the accident rate. Table 3-17 shows accidents per bus-hour of

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[16] J. Attanucci, N. M. Wilson, & D. Vozzolo (1984). An assessment of the use of part-time operators at the Massachusetts Bay Transportation Authority. In Transit Performance Evaluation and Auditing. (Transportation Research Record No. 961). Washington, DC: Transporation Research Board, pp. 21-28.

service, as a function of time. The table is in three main parts: accidents on weekdays, Saturdays, and Sundays. For each of the three parts we show the number of accidents, the number of buses in service at that hour, and then accidents per bus-hour. (We multiply the number of weekday buses by 5 before dividing: accident rates are for the whole five day week, so number of buses needs to be expanded to match it. The final rates are multiplied by 100 for ease of presentation.)

There are a number of things to note in Table 3-17. Looking at column 3, the PTO accidents occur during the daily peak hours, because that is the period when these operators are utilized. Note that accidents per bus-hour vary considerably by time of day; ranging from a low of .38 accidents/bus at 5AM to a high of 4.52 accidents/bus at 4PM.

Finally, and quite surprisingly, the weekend rates are not very different from the weekday rates, despite the substantially lower weekend traffic. Not only are the accident levels similar between weekday and weekend, but even the hourly patterns seem similar. One possible explanation of this data is that accidents vary as a function of the daily human cycle, not the daily traffic cycle. Obviously, more work is needed before such a generalization can be made with confidence, but it is a fascinating notion. In any event, whether the daily pattern of accidents is due to congestion patterns, or to some inherent human cycle, the important consideration for our analysis is that PTOs drive during those periods when accident rates are at their highest.

To standardize for the greater exposure of PTOs to high-accident driving times, we compute the following. The great share of PTOs drive during two time periods, 6-8AM and 3-6PM. During this period there are 877 total accidents, and there are 5505 buses in daily operation. The accidents occur over the entire five day week, so we multiply buses by five, and compute: accidents peak bus-hour = 3.19; (multiplying the ratio by 100 for ease of presentation). There are 504 accidents during the non-peak weekday hours, and there are 3840 buses in service, thus we compute 504/(5x3840); for Saturday there are 106 accidents and 4023 bus-hours of service; and for Sunday there are 64 accidents and 3047 bus-hours of service. Thus the average accident rate for the non-peak hours is 2.57 accidents per bus-hour of service. Only FTOs drive during these low danger, non-peak hours; the PTOs all drive during the high danger peak-hours.

TABLE 3-17
DAILY PATTERN OF ACCIDENTS

	WEEKDAYS					SATURDAY			SUNDAY		
Hour	#FT Acc	#PT Acc	Tot Acc	# Bus	Acc Bus	#FT Acc	# Bus	Acc/ Bus	#FT Acc	# Bus	Acc/ Bus
4am	0	2	2	70	.57	0	10	.00	0	9	.00
5	3	4	7	373	.38	2	84	2.38	0	54	.00
6	14	23	37	818	.90	0	173	.00	2	119	1.68
7	51	61	112	846	2.65	2	202	.99	0	137	.00
8	62	67	129	769	3.36	4	218	1.83	0	149	.00
9	45	9	54	460	2.35	7	227	3.08	3	159	1.89
10	49	0	49	300	3.27	3	231	1.30	2	167	1.20
11	46	0	46	303	3.04	10	232	4.31	3	175	1.71
noon	67	0	67	306	4.38	8	233	3.43	3	183	1.64
1	72	0	72	383	3.76	11	236	4.66	5	180	2.78
2	87	15	102	452	4.51	6	234	2.56	7	175	4.00
3	87	71	158	702	4.50	11	233	4.72	4	176	2.27
4	92	98	190	841	4.52	15	233	6.44	10	177	5.65
5	73	99	172	845	4.07	7	240	2.92	3	179	1.68
6	39	40	79	684	2.31	3	234	1.28	3	180	1.67
7	27	6	33	328	2.01	4	200	2.00	4	158	2.53
8	24	0	24	173	2.77	3	155	1.94	2	142	1.41
9	19	1	20	162	2.47	3	147	2.04	5	140	3.57
10	12	0	12	154	1.56	3	136	2.21	4	132	3.03
11	4	0	4	130	.62	1	125	.80	1	124	.81
Mdnt	4	0	4	112	.71	1	107	.93	0	108	.00
1	5	0	5	85	1.18	2	82	2.44	3	108	2.78
2	2	0	2	42	.95	0	44	.00	0	82	.00
3	1	0	1	7	2.86	0	7	.00	0	43	.00

Acc/Bus: Accidents per bus in service (x 100).
For weekday runs, # buses multiplied by 5 before computing Acc/Bus.

Taking the ratio of these two figures, we would expect that other things equal the more dangerous driving hours of the PTOs would lead to a 24% higher accident rate. Next, we look at the effects of driving experience and hours of exposure.

Table 3-18 computes accidents per operator (over the ten month period) separately for the different experience-cohorts of PTOs and FTOs. Looking at the top of the table, notice that as experience increases, the accident rate of full-time operators does decline: from 1.52 accidents per operator for the operators with one year of experience down to .92 accidents per operator for those with five years of operating experience. The same trend is not apparent for the PTOs however; in fact their accident rate seems remarkably stable and independent of driving experience.

However this apparent stability is only an artifact of the differences in driving exposure.

TABLE 3-18
EFFECT OF EXPERIENCE ON THE ACCIDENT RATE

Years of Experience	Accidents/Driver Full Time	(#)	Accidents/Driver Part Time	(#)
1	1.52	(114)	.46	(77)
2	1.02	(49)	.42	(91)
3	2.40	(12)	.45	(95)
4	.84	(58)	.51	(101)
5	.92	(197)	.77	(51)
Average	1.05		.48	

Adjustment for Differential Exposure by Part-Time Seniority

Years of Experience	Average PTO Tripper Min.	Accidents per PT Operator
1	140	1.34
2	157	1.10
3	204	.90
4	240	.87
5	330	.96
Average		1.03

#: number of accidents used in computing the rate.
Data are for a 10 month period at transit Seattle METRO.

For the FTOs, the work week tends to be relatively independent of years of experience: for their first five years at Seattle METRO, all FTOs work approximately a forty hour week (as they acquire considerably more seniority, they can bid for runs with more overtime or more guarantee pay). However, the story for the PTOs is quite different. PTO trippers range from 2.5 hours to almost 6 hours in length, and there is considerable competition to receive the long runs, since these offer the highest pay. We do not have data on the average driving time for each experience-cohort of part-time operators, but we do have data on the number and length of PTO trippers. Since PTOs bid for trippers at this agency, and since our operator interviews told us that the longest trippers were the most desirable, we performed a simple bidding simulation: the longest trippers were assigned to the PTOs with highest seniority and any leftover long-trippers were assigned to the next highest seniority group of PTOs; then the next longest group of trippers were assigned to the remaining PTOs with highest seniority; and so on.

The bottom part of table 3-18 shows the results of our tripper assignment process. Column 2 shows the average PTO tripper varying between 120 and 330 minutes, depending upon the amount of PTO seniority. To compute the final column: (a) first compute the ratio (FTO platform time divided by average PTO tripper time), for each PTO experience cohort; (b) next divide the raw PTO accident rates, from the top of the table, by the time-ratio computed in part (a). Note that the PTO accident rate now varies with driving experience, as expected. Also note that the PTO accident rates tend to be lower than, or about the same as, the FTO rates, at each level of experience.

Overall, holding constant amount of driving experience and hours of exposure, the average FTO accident rate is 1.05 and the PTO rate is 1.03. (Computed using driver-weighted averages.) These results do not standarize for differences in exposure to dangerous driving times, and that 24% adjustment would make the comparative PTO rate even lower. Thus we conclude that after standardizing for hours of driving, exposure to dangerous driving, and years of driving experience, part-time operators have lower accident rates than full-time operators.

ATTRITION RATES AND THE EFFECT OF HIRING THE "WRONG" PEOPLE

Attrition is of interest because it increases training costs and accident rates (high attrition rates mean that a higher proportion of operators are still on the high-accident portion of the experience curve). It had always been expected that PTOs would have higher attrition rates than FTOs -- it was less likely that people would regard part-time work as a permanent career. But it is possible that the attrition rate is even higher than it needs to be because management may be recruiting the wrong people altogether.

By "wrong" people, we mean that most of the current PTOs had actually wanted full-time work. We did not run surveys among the PTOs to calculate the proportion who really wanted full-time work, but we did ask both the unions and the managers to make a subjective estimate of this proportion. There was universal agreement on an estimate that 70-85% of the PTOs wanted full-time work. Such PTOs will, of course, leave as soon as suitable full-time work becomes available. If they transfer to a full-time position at the transit agency then there is no loss of training and experience, but in an era of constant, or even declining, transit service, it is unlikely that many PTOs will simply be able to transfer within the agency.

The Operations staff at these agencies was well aware of the problem of hiring the wrong operators. But in four of the five case study agencies we found no evidence that the Personnel Office had made any serious, determined effort to screen out those PTOs who were only taking part-time work as a temporary expedient. Indeed, at one of the four agencies it appeared as if the Personnel Office had deliberately structured the hiring process toward people who would want full-time work: the hiring office was located in the midst of a high-unemployment area (the kind of place where true part-time candidates, housewives, students, etc., were unlikely to go); it was only open for a few hours per week, and only at a time when employed candidates would be at work; and it refused to accept job applications at its suburban divisions.

We can construct an indirect estimate of PTO attitudes toward full-time work by looking at the relation between PTO quit rates and the general economic conditions in the area. If PTOs really want full-time work, then quit rates will be low during periods of high unemployment in the local area, and when the local job market becomes tighter we would expect PTO quit rates to rise significantly. The calculation cannot be done in a simple manner, however, since the effects of operator longevity must also be standardized. Quit rates vary as a function of experience, and are likely to be highest in the early years when the operator is still trying to figure out if this is really the kind of job he wants. Thus it was necessary to compute the "expected" quit rate for PTOs -- expected, as a function of experience -- to use as a baseline when comparing PTO quit rates to economic conditions.

Table 3-19 shows the results. It follows five PTO cohorts through their career at this agency, and shows the relationship between PTO quit rates and the general economic conditions in the local economy, as measured by local unemployment rates. Each row is the time path of one cohort. The numbers in the row are (Actual Quit Rate - Expected Quit Rate) where expected quit rate was computed from the average career path of all the PTOs at this agency, and the quit rate is expressed as a function of experience. A minus sign in the table means that the driver-cohort has had less attrition than might be expected on the basis of experience alone, and a plus sign means that the cohort has had greater attrition than would be expected, given their level of experience.

TABLE 3-19
A SUBSTANTIAL NUMBER OF PTOs REALLY SEEM TO WANT FT WORK, HENCE PTO QUIT-RATES GO UP WHEN LOCAL-AREA JOBS ARE PLENTIFUL, AND GO DOWN DURING RECESSIONS

1979	1980	1981	1982	1983	1984
Steady	Steady	Rising	Rising	Falling	Falling
Hired	+ 2.0'	+ 1.1'	- 0.4*		
	Hired	- 2.0*	- 4.2*	- 0.9'	
		Hired	- 7.6*	0.0	+ 1.2*
			Hired	+ 0.7*	+ 3.1*
				Hired	+ 7.2*

First row shows unemployment conditions during that year, e.g., "Rising" means the unemployment rate increased that year.
For each cohort of PTOs, the row shows year-hired, and the subsequent quit-rate compared to the experience standardized rate.

"*" = Supports Hypthesis ' = Contradicts Hypothesis
Sum of Confirming Deviations = 26.4
Sum of Contradictory Deviations = 4.0

The results in Table 3-19 provide evidence that many PTOs are only marking time until full-time work becomes available somewhere. It indicates that PTO quit rates rise during boom times (when, presumably, it is easier to find full-time work somewhere outside the transit agency); and that PTO quit rates fall during recessions, when outside opportunities are reduced. Clearly, quit rates are inversely related to economic conditions, and many of the operators really wanted some other kind of work.

IMPACTS OF PTLI ON FULL-TIME OPERATORS

Proposals to implement part-time labor have been met with strong union opposition. We examine two major union objections here: FTO job security, and working conditions. We also discuss an important recent innovation, temporary part-time status for FTOs.

FTO Job Security

The most obvious way for a transit agency to introduce part-time labor is to substitute PTOs for existing FTOs. Indeed, in the absence of service expansion, that is the only way to introduce PTOs. Union negotiations have consequently made FTO job protection a top priority condition for accepting PTLI. Table 3-20 shows that

four of our five case study agencies have some form of FTO job protection clause in the initial PTO labor contract, and that it has remained (and in one case been expanded) in subsequent contracts. The one agency without such a provision is unique in that the agency is new and the labor agreement is non-binding.

TABLE 3-20
FTO JOB PROTECTION PROVISIONS AT CASE STUDY AGENCIES

	Seattle METRO	OCTD	SEMTA	TRI-MET	CCCTA
Initial PTO Contract	Guaranteed number of FT runs	PTOs laid off first	Guaranteed number of weekday FT runs	PTOs laid off first	None
Change in later Contract	Guaranteed number of FT runs increased	No change	No change	No change	No change

The APTA data discussed in Chapter One indicated that almost half the agencies surveyed have a "PTO laid off first" provision. It did not ask about any "size of full-time workforce" guarantees, like those of Seattle METRO and SEMTA But if our case study agencies are at all representative, we can conclude that some form of FTO job protection provision is part of most PTLI contract agreements.

It is easy to understand why FTO job protection clauses are widespread. On the union side, it was most almost certainly a non-negotiable condition for PTLI acceptance. On the management side, PTLI was initiated during a period of transit service expansion, before the fiscal crisis of the early 1980's, and there was no anticipation of service cutbacks. At the time then, there was little reason not to accept such a condition. Our data indicate that FTOs have been quite successful in obtaining job protection guarantees and keeping them in later contracts, despite service cutbacks which, at many agencies, have resulted in the loss of all PTOs.

FTO Working Conditions

In this section, we examine two aspects of FTO working conditions: extra pay, and weekend work.

Spread premiums and overtime payments, in theory, represent extra compensation for unusually onerous assignments. If such assignments are

eliminated, the operator loses some income, but gains more pleasant work. The net impact on a given operator depends on whether the premium payments over- or under-compensate for the undesirability of the split runs. Thus it is not clear how much of a welfare loss, if any, this represents for full-time operators.

To what extent does FTO compensation decline as a result of PTLI? Full time operators can lose the chance to earn premium or overtime pay in two ways. First, at some agencies, full-time operators now volunteer to drive trippers in addition to their assigned runs. In the absence of a contractual agreement to the contrary, such trippers will generally be reassigned to part-time operators. Second, full-time operators can lose the chance to earn premium pay when long split runs are reassigned to PTOs. (At agencies with a high peak/base ratio, split runs pay more than straight runs but may involve fewer hours of work.)

Table 3-21 gives data on FTO pay and work hours for TRI-MET, with and without PTOs, for a static service schedule. In this case, pay hours per FTO and overtime hours per FTO are almost identical under each schedule. However, platform hours per FTO increase in the PTLI column, indicating that, on average, FTOs must work longer for the same pay. Straight runs increase and split runs decrease with PTLI, so we infer that FTOs are being assigned longer straight runs, while PTOs are being assigned the longest splits. (TRI-MET gives PTOs 2-piece daily assignments.) The table also shows that make-up pay and spread overtime pay are drastically reduced with PTLI.

TABLE 3-21
FTO PAY AND WORK HOURS, WITH AND WITHOUT PTLI

	No PTOs	PTLI
#FTOs	615	532
Total Pay Hours	5657	4887
Regular Pay Hours	4920	4256
OT Pay Hours*	737	631
Platform Hours	5062	4491
Pay Hrs/FTO	9.20	9.19
OT Hrs/FTO	1.20	1.19
Platform Hrs/FTO	8.23	8.44
Make-Up Pay Hrs	138	46
Spread OT Hrs	188	87
Straight Runs	367	386
Split Runs	248	146

*OT = Overtime

At Seattle METRO we have actual data on the effects of PTLI. The introduction of part-time operators decreased the proportion of split runs from 41% to 31% of the full-time runs. Since split runs pay 15% more than straight runs (on average), but require slightly less work time, FTO compensation has clearly decreased.

At OCTD management decided to avoid impacting full-time runs, since the contract prohibited modifying full-time runs to create PTO work. Thus PTO runs consist primarily of the longer trippers that were formerly worked by the extraboard. Using runcut data from "before" and "after" PTLI, we found that average platform time for regular runs increased by 9 minutes, while average pay time increased 23 minutes (4.1%) for straight runs, and increased one hour (10.6% for split runs. That is, FTO compensation per regular run increased after PTLI. This seems to have resulted from a change in runcutting procedure which reduced the total number of FTO runs, and was unrelated to PTLI. Moreover, while the ratio of split runs to total runs declined, the decline is entirely attributable to the reduction in peak/base which occurred over the same time period. At OCTD, we conclude that PTLI had no impact on FTO Compensation. This is not surprising, given that our calculations in Chapter Two indicated that PTLI generated inconsequential cost savings.

Results from both actual and experimental data indicate that when PTLI is effective (from management's standpoint), FTO compensation declines but the quality of their runs improves. In some cases, however, the impact on FTO incomes can be ameliorated by the use of biddable trippers. These are short pieces of work, usually less than 1.5 hours which are voluntarily worked by an FTO in addition to his/her regularly scheduled run. The operator receives overtime for the tripper, but does not collect a spread premium for additional fringe benefits. The flexibility and voluntary nature of the biddable trippers appeals to FTOs. They may be beneficial to management as well: biddable trippers are too short to make useful part-time assignments, and their cost is relatively low. (Since the fringe benefit rate is typically about 50% of wages, one straight-time hour of FTO work costs the agency about 1.5 pay hours. An FTO working a biddable tripper receives overtime but no extra fringe benefits, hence one hour of work still costs the agency 1.5 pay hours. From the viewpoint of the transit agency, biddable trippers are being worked at straight-time costs.) As PTOs take up longer peak-hour work, more FTOs are shifted to early or late straights, which are ideal matches for biddable trippers.

Seattle METRO and OCTD make use of biddable trippers. During the part-time era, the number of biddable trippers has declined at Seattle METRO and remained stable at OCTD. We do not know of an agency which has increased the number of biddable trippers available after implementing part-time labor.

Regular Days Off: Who Drives on Weekends?

A related source of concern for FTOs is a perception that PTOs can crowd them out of desirable Monday-through-Friday assignments. At the heart of the issue is a fundamental scheduling problem: someone has to drive the weekend runs, but most operators would prefer not to. Seniority therefore determines a FTOs regular days off. Senior operators usually bid for Saturday and Sunday off, leaving their juniors with less desirable schedules. At most agencies PTOs are not permitted to work on weekends. To the extent that PTOs displace FTOs from weekday work, an FTO perceives a deterioration in his chances of getting weekends off.

Are these perceptions justified? We explore this issue using data from Seattle METRO The issue is confused by an 1980 change in scheduling practice. Prior to 1980, all weekend work had been handled by extraboard operators. Adoption of the current seniority-based system shifted much of the burden of weekend work away from extraboard operators to regular FTOs. The regular FTOs chance of a free weekend thus drastically deteriorated at the same time that PTO recruitment was booming, for independent reasons.

Scheduling regular days off is sometimes seen as an arcane process, but the FTOs prospects for a weekend off are easily calculable. The number of weekend runs (including extraboard positions) determine the absolute number of operators who must work weekends. Thus the introduction of PTOs on weekdays cannot directly affect the absolute number of weekend-off assignments (unless, for some strange reason, the agency decides to expand weekend service). The ratio of weekend runs to weekday runs governs the proportion of FTOs who must accept weekend work.

Comparing data on weekend runs as a proportion of total regular runs, we find that PTLI affected neither the number nor proportion of regular FTOs receiving weekends off. We conclude that PTLI did not impair the FTOs objective chances of securing work-free weekends. However, subjective perceptions may be drastically different. If the peak service added during the post-PTLI expansion had been

staffed by FTOs rather than PTOs, an FTOs chances of receiving weekends off would have been greatly increased.

As Chapter One indicated, the majority of agencies restrict PTOs to weekday work. However, changing this restriction would benefit both FTOs and PTOs. For example, weekend work is handled exclusively by PTOs at CCCTA. There is no service on Sunday; but each PTO is assigned an eight to ten hour Saturday run, plus weekday trippers. This scheme has a number of advantages. First, it gives PTOs a respectable income -- approximately thirty hours per week. The job is therefore potentially able to attract a whole new class of applicants: those for whom 15 to 20 hours/week is too little, while 40 to 45 is too much. Second, FTOs are assured weekends off, a privilege that would otherwise take years of seniority to earn.

Given the advantages of utilizing PTOs on weekends, it is difficult to understand why so many labor agreements restrict PTOs to weekday work. It may be that the weekday-only restriction was an initial (c. 1977) response by unions concerned about maintaining a distinction between full-time and part-time employees. In any case, it is a provision which seems now to be detrimental to both parties.

A Part-Time Option for Full-Time Operators

The 1980 contract at SEMTA contained an important innovation: full-time operators are permitted to temporarily bid for part-time positions without jeopardizing their full-time status or seniority. All that is required is permission of the division manager. Upon return to full-time status, the operator receives back his/her former seniority plus 3 months. No additional seniority is accrued during part-time status. Because of the rapid transfer of PTOs to FTO status and the later service cutbacks which eliminated the PTO position, this provision was never implemented.

More recently, however, OCTD adopted a similar provision. All full-time positions and about half of the part-time positions fall into a common category, Classification I. All Class I operators, whether part-time or full-time, receive full fringe benefits and accrue seniority on the same roster. At the triannual shakeups, all Classification I positions are posted for bid according to seniority by Classification I operators. Most of the Class I positions (which total 4% of the full-time positions) are filled by FTOs who want PTO work. If there is a shortfall of

FTOs wanting part-time work, then it goes to the low seniority operators. This does not mean that the operators who bid for PTO runs want permanent part-time work, rather the great majority are simply rotating through PTO status. That is, for Class I operators, part-time work is now a significant additional option for them to choose: they keep full benefits and full seniority rights, but get the chance to cut back on work hours for a while. For some operators, it is an opportunity to spend more time withe their children during the summer months; for some operators it is a chance to recuperate after a long period of sickness or "burnout"; and for others it is a chance for a semi-vacation. To the extent that absenteeism is an index of operator morale, it is significant that absentee rates of the Class I PTOs are much lower than those of the FTOs; and at least 5 of the PTOs have repeatedly passed up the chance to bid full-time work. Meanwhile, every high-seniority driver who elects to work part-time opens up a full-time slot for a low-seniority driver. To the extent that the latter is ultimately aiming for a permanent full-time position, these are welcome opportunities to boost income while accumulating seniority. The head of the union regards the new system as a major benefit for the operators.

The two class system has benefits for management as well as PTOs and FTOs. The Classification II operators are restricted to part-time work, have a separate seniority roster, and do not receive fringe benefits. They are also permitted to work weekends. Since OCTD formerly paid full benefits to all PTOs, the new system enables the agency to use lower cost PTOs.

The two class system is an option which deserves close attention from other agencies. The program boosts welfare and morale among both FTOs and PTOs at no incremental cost to management, and is certainly a means of making PTLI more palatable.

Summary

Our research shows that impacts of PTLI on full-time operators are mixed. First, unions have been highly successful in protecting full-time positions. Thus PTOs have been hired primarily through service expansion, and they have been lost as a result of service reductions. Second, when part-time labor is implemented effectively, (i.e., when cost-savings result), these cost savings reflect a loss of overtime and premium pay to full-time operators. However, these pay losses to FTOs are offset by the more pleasant work now available to FTOs. Third days-off

for FTOs have not been adversely affected by PTLI. Furthermore, if restrictions preventing PTOs from working on weekends were lifted, PTLI could result in weekends off for more FTOs. Finally, at least two agencies give FTOs the option of shifting to part-time work on a temporary basis, adding a new dimension of flexibility to the full-time job.

SUMMARY OF THE RESULTS AND THE SUPPORTING EVIDENCE

1. *PART-TIME WORK HAS INHERENTLY LOWER ABSENTEEISM.* PTOs have lower sick rates than FTOs, and we found this result across a wide variety of situations. Furthermore, the conclusion held even when PTOs and FTOs received identical sick pay benefits, whether the benefits were identically high or identically low: when both PTOs and FTOs receive paid sick leave, the FTOs have higher absenteeism; when neither PTOs nor FTOs receive paid sick leave, the FTOs have higher absenteeism. We reached the same conclusion when we followed an identical cohort of operators moving from full-time to part-time status. And we reached the same conclusion when we factored out the effects of probation on the behavior of PTOs.

2. *INCREASE IN SICK PAY BENEFITS CAUSE AN INCREASE IN ABSENTEEISM.* Even though the sick pay differences between PTOs and FTOs are not sufficient to explain the difference in absenteeism, we found that sick pay does matter. Specifically, we found that increases in the amount of paid sick leave available to an operator cause an increase in observed absenteeism. We found this result for FTOs, when comparing those with sick pay to those without. And we found this result for PTOs, when comparing those with sick pay to those without. Finally, we found this same result when we tracked the sick rates of FTOs over-time as they moved into jobs with higher amounts of paid sick leave. In quantitative terms, we found that successive increases in sick pay -- from 0 days, to 3 days, to 5.2 days, to 12 days per year -- were associated with successive increases in the observed rate of sickness.

We regard conclusions (1) and (2) as being very strongly supported by the data. Conclusions (3) - (6) are supported by more limited data, typically involving only one or two agencies.

3. *PTO ACCIDENT RATES ARE ROUGHLY SIMILAR TO FTO RATES.* This is confirmed in the rough, unstandardized data at all the agencies. But only one

agency provided sufficient data to fully standardize for differences in driving exposure between PTOs and FTOs. At that agency, holding constant hours of driving, years of experience, and the daily time-pattern of accident hazards, we found that PTOs had lower accident rates than FTOs.

4. *IRREGULAR WORK CAUSES INCREASES IN ABSENTEEISM AND ACCIDENTS.* This is supported by data from a single transit agency, but it is the theoretically expected relationship.

5. *THERE IS A TENDENCY TO HIRE THE "WRONG" PEOPLE FOR PART-TIME WORK.* First, casual estimates from managers or unions at all five agencies indicate that 70-85% of the PTOs really want full-time work. Second, at one agency with detailed data available, PTO quit-rates go up when more jobs are available outside the transit industry, and they go down when area-unemployment increases. The consequences of hiring the wrong part-timers are varied. Higher attrition produces higher training costs but lower average wages for PTOs -- because new PTOs are constantly coming in at the start of the wage progression. Higher attrition also produces higher accident costs because a higher proportion of the PTOs will be on the low-experience portion of the accident curve. (This does not contradict conclusion (3), which indicates that experienced PTOs will have even lower rates than the average PTO.)

6. *FTOs HAVE LOST PREMIUM PAY AND OVERTIME, BUT GAINED HIGHER QUALITY RUNS.* The loss of such pay is confirmed by a variety of data, and is not surprising since PTLI was designed to eliminate the kinds of runs that generated premium and overtime pay. On the other hand, those special pay categories were created to compensate operators for long onerous runs. Thus the loss of these runs should offset most/all of the loss of the special pay.

7. *SOME EXTENSIONS OF THE PTO CONCEPT WOULD BENEFIT EVERYONE.* These are: (a) Allowing PTOs to work weekends gives PTOs the extra pay they want, and gives FTOs the free weekends that they want, (b) Allowing FTOs to do an occasional, temporary stint of part-time work broadens their range of choices, and opens up extra pay opportunities for PTOs. This has been tried at one agency, and the FTOs think it is a good change.

CHAPTER FOUR

CONCLUSIONS

This report has examined both fiscal and organizational issues associated with the use of part-time operators. Using data from five transit agencies covering a significant range of sizes and operating environments, we have traced the direct and indirect impacts of part-time operators.

SUMMARY OF RESEARCH RESULTS

Impact of PTLI on Cost-Savings

The 1981 Chomitz and Lave[17] estimates of cost savings from part-time labor are correct in terms of the predicted pattern of savings, and the dependence of savings on specific work-rule and schedule factors, but the 1981 estimates are a bit high in terms of the overall level of savings. That is, the pattern of results is as expected, but it should be shifted downward somewhat. This is the expected outcome since the 1981 forecasts were deliberately formulated as upper bounds on PTLI savings -- the climate of that time tended to regard PTLI as a panacea for transit's problems, and we wanted to show that even an upper bound estimate was well below many of the claims that were then being circulated.

In addition to the upward bias inherent in an upper bounds analysis, there are two other reasons why any estimate of potential PTLI savings will tend to be optimistic. First, it is difficult to anticipate all the contract details that will constrain implementation. Management may win the right to use, say, 10% PTOs, but in practice it turns out to be quite difficult to actually reach that limit. A variety of seemingly innocent contract provisions (see Chapter Two) tend to become major restrictions on the planned use of PTOs, though many of these consequences

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[17]K.M. Chomitz & C.A. Lave (1981). Part-time labor, work rules, and transit costs. Irvine, CA: University of California, Institute of Transportation Studies and School of Social Sciences.

can be discovered in advance if management will perform experimental runcuts to evaluate the prospective contract changes.

A further reason why forecasts prove higher than experience is the problem of keeping the PTO complement filled: attrition and transfer of PTOs to full-time status may keep PTOs at the 8-9% level, instead of the 10% that was bargained for. This is a 10-20% shortfall in implementation, and in anticipated savings.

A Better Method for Estimating Impact of PTLI on Cost Savings

We were able to develop a simpler method for predicting the effects of PTLI. The old method[18] had described forecast procedures in terms of the peak/base ratio at a given transit agency. This worked well as long as the given agency had relatively standard work rules, but produced quite biased results when it did not. In practice, forcasting with the old method required considerable judgement.

The new procedure places primary reliance on initial pay/plat (the pay/platform ratio prior to PTLI). The theoretical advantage of this approach is that the pay/plat ratio simultaneously incorporates the effects of work rules and of peak/base ratio: for example, a peaky agency with loose work rules, and a flat agency with strict work rules might both have the same pay/plat ratio. And a prediction method based on pay/plat would forecast roughly equal savings for them under PTLI; a prediction method based on peak/base would begin by forecasting quite different savings. Then, depending on the judgement of the forecaster, the results would be modified to incorporate the effects of work rules. Thus, forecasts based on pay/plat are both more objective and easier to make.

The Bargaining Costs of PTLI

Our analysis of the bargaining costs of PTLI examined possible givebacks in wages and fringe benefits. Using regression analysis on a cross section of 41 transit agencies (holding constant the effects of agency size and regional wage levels), our best estimate is that management traded a 6% increase in fringes and 3.7% increase in wages for the right to use PTOs. The fringe benefit estimate is statistically significant; the wage increase estimate is not quite statistically significant, though

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[18]K.M. Chomitz and C.A. Lave (1981). Part-time labor, work rules, and transit costs. Irvine, CA: University of California, Institute of Transportation Studies and School of Social Sciences.

the estimated giveback is strikingly consistent across different equations. Since the cost of these estimated givebacks is about equal to the cost saving from PTLI, this issue definitely merits further investigation.

Job Performance of PTOs

In the two major areas of job performance, absenteeism and safety, we found the PTO record to be as good or better than that of FTOs. Our data indicate that PTO sick rates are lower than FTO rates, even when PTOs and FTOs receive identical sick benefits, even factoring in the effect of probation. Furthermore, FTO sick rates decline when drivers move to part-time status. We conclude that part-time work has inherently lower absenteeism. We speculate that part-time work is less demanding than full-time work: it is easier to work a short assignment than a long one if you are feeling sick; and part-time work allows more time for necessary personal activities within normal business hours. For example, parents can accommodate a child's medical appointment without having to use their own sick leave.

Our analysis also found that increases in sick pay cause increases in absenteeism: sick rates increase about half as much as the increase in sick pay. This increase occurs for both FTOs and PTOs.

Our examination of accident data indicates that PTO and FTO accident rates are comparable. In the one case where sufficient data were available to standardize for differences in driving exposure, we found that PTO accident rates were lower than FTO rates (holding constant hours of daily exposure, time of day, and years of experience). The gross accident rate of PTOs was lower at the other agencies, as well, but we lack the data to say whether the standardized accident rate would have been lower.

We conclude that the performance of PTOs has been at least as good as FTOs, and the fear that PTOs would not have the capabilities and commitment of FTOs has proven to be unfounded.

Most PTOs are Seeking Full-Time Work

Our case studies indicate that attrition rates among PTOs are generally high, because most PTOs are really seeking full-time work. PTO quit rates seem to be tied to general economic conditions and the chances for obtaining full-time work

within the agency. Transit agencies have not targeted recruitment to the permanent part-time market (e.g., students, retirees, those looking for a second job). In fact, the characteristics of the job may be incompatible with some potential sources of part-time market workers. For example, the seasonal schedule changes may cause conflict with school classes, making it difficult for students. And peak-only work clearly conflicts with many childcare schedules. As it has evolved so far, the PTO job is principally being used by those interested in full-time work; it has become a steppingstone into the full-time labor force.

Impact on PTLI on FTOs

The impact on the FTOs when agencies adopt part-time labor has not been entirely negative, and could easily be improved. PTLI reduces extra pay to FTOs through reductions of overtime and premium pay. But such pay only exists in the first place as compensation for the burden of long work hours. Hence management argues that to the extent that the rates for overtime and premium pay were correct in the first place, then the loss of such pay is exactly compensated by the gain from dropping the long work hours which justified it. PTLI also reduces the number of instances where FTOs have worked short shifts and then received guarantee pay to bring them up to eight hours of pay. To the extent that such runs disappear, there is indeed a loss in welfare to the high seniority FTOs who had them. An editorial in the union newsletter at one of the sample agencies summarizes the attitude of FTOs toward all these changes:

> "(Formerly) there was lots of 'gravy.' It was not uncommon to work a 6-hour shift and be paid for 8." But the agreement to allow PTOs "... sold out ... all benefits and privileges which the Union had gained through seventy-five years of struggle." After that, the FTOs "... began to see the quality of work available to them deteriorate." (Seattle METRO, July 1983)

Contrary to common assertion, PTLI has not reduced the chances of FTOs getting weekends off. Moreover, FTOs have adamantly opposed any proposal that PTOs be assigned to weekend shifts, though such a change would allow more FTOs to have the weekend off. (One union official explained his opposition to the change by saying that his goal was to keep part-time labor as minimal and restricted as possible.)

PTLI has also provided a new dimension of choice and flexibility for FTOs at two agencies: their FTOs are permitted to volunteer for temporary stints of part-time work, with no loss of benefits or seniority. Some FTOs have used this option to gain a period of extra rest following stressful events, and some have used it as a chance to spend extra time with their children during the summer. This provision benefits FTOs at little cost to the transit agency and is certainly worth consideration by other agencies.

In sum, then, PTLI has been both less effective in saving money and less damaging to FTOs than originally claimed by its advocates and opponents.

Evolution of PTLI and Implications for Cost-Savings

Extending the duration of our research to two years enabled us to conduct follow-up interviews and trace PTLI through at least one subsequent contract. Changes which have taken place in these later contracts indicate that the difference between part-time and full-time operator positions is decreasing.

At Seattle METRO, subsequent contracts have brought increases in PTO guarantee time, a PTO spread provision, sick pay, and increased fringe benefits. The 1981 contract increased the guarantee per tripper from 1:30 to 2:20 hours. The 1983 contract provided for some two-piece PTO daily assignments with a 5 hour guarantee and a spread premium after 12 hours. In addition, biddable trippers were provided for PTOs. This contract also provided for PTO vacation benefits, beginning in 1986.

At OCTD, the 1980 contract gave PTOs full fringe benefits. The shift to the two class operator system -- described in the case studies -- partially rolled back this provision in 1983. (However, since Class I positions must be filled first, Seattle METRO has so far been able to hire very few Class II PTOs).

No changes in PTO conditions have been made at SEMTA, TRI-MET, and CCCTA. However, at SEMTA, there has been no advocacy group for PTO improvements, because service cutbacks resulted in the loss of all PTOs in 1982 and a size of workforce guarantee has prevented rehiring PTOs since. CCCTA has highly unusual PTO conditions, which are substantially different from transit industry norms, as will be discussed in a later section of this chapter. TRI-MET has been under so much fiscal pressure, it has had no choice but to "hold the line" on PTO work conditions.

The APTA data cited in Chapter One also indicated a trend toward increased fringe benefits for PTOs. Since the low level of PTO fringe benefits accounted for a substantial portion of the cost savings from PTLI, these changes will erode the fiscal advantage of part-time labor.

The history of greatly increased fringe benefits and working conditions at Seattle METRO is particularly significant, because its experience with PTLI has been the longest. To the extent that the great majority of PTOs really want full-time work, they will tend to view the PTO assignment as an inferior substitute, rather than as a desirable way to earn extra income in their spare time. We would expect such employees to exert pressure aimed at equalizing the differences between part-time and full-time work. Furthermore, as PTOs become a more influential component within the union, we would expect more advocacy on their behalf. This is precisely what has happened at Seattle METRO.

PTLI IN THE CONTEXT OF OTHER COST SAVING STRATEGIES

The era of rising transit subsidies has given way to a time of fiscal constraint. Transit managers who were formerly encouraged to concentrate on service expansion have now been told to concentrate on cutting costs. Part-time labor is one way to improve cost efficiency. Alternative actions include: (1) improving schedule efficiency, (2) reducing absenteeism, (3) reducing extraboard staffing, (4) improving work rules and, (5) use of contract service. The first three alternatives are generally within the purview of management, i.e. not subject to contract negotiation, whereas PTLI or changes in work rules must be negotiated with the union. Contracting out peak service to low cost providers (usually private) is by far the most extreme and controversial alternative, but one which is receiving increasing attention. How does PTLI compare to these other cost-saving measures?

Schedule efficiency can be improved by adopting automated runcutters (some older agencies are still using manual methods), and adjusting vehicle schedules to optimize within the contraints of current work rules. Comparisons of manual and automated runcuts in the early days of RUCUS indicated about a 2% improvement in the pay/platform ratio. People familiar with the latest automated runcutters believe that an additional 1-2% improvement is likely.

Schedule efficiency can also be improved through better integration of the planning and scheduling functions. Schedulers at two of our larger case study agencies cited this problem; it seems likely that such compartmentalization of functions is a result of agency size. In contrast, at our smallest agency, where feedback between planning and scheduling is routine, the pay/platform ratio was 1.04, essentially the theoretical minimum. Improvements in the scheduling process are easier to implement than PTLI, and in some cases could lead to comparable cost savings.

Better control of absenteeism appears to have significant cost saving potential. The "no fault" absence policy at OCTD resulted in a 1.8% drop in the FTO absence rate (see Chapter Three), and the large variation in absenteeism among transit agencies suggests considerable scope for improved management action. If a drop in absenteeism is accompanied by a corresponding reduction in extraboard staffing, there would be a decline in costs. In transit agencies with a flat schedule and/or favorable work rules, a reduction in absenteeism will generate greater cost savings than PTLI; at OCTD, the saving was 50% greater. Furthermore, reduction of absenteeism generally involves nothing more than increased enforcement of existing absence policy, and can be implemented without contract negotiation. A policy which might involve negotiation is that of SEMTA: it guarantees its FTOs a 40 hour week rather than an 8 hour day; hence an unauthorized absence leads to loss of guarantee pay for that week. This seems to provide a substantial extra incentive toward operator reliability.

Extraboard staffing has been recognized as an extremely difficult and complex problem.[19,20] Basically, the problem is one of uncertainty: the agency must have enough operators standing by, paid but idle, to cover the large daily fluctuations in absenteeism. The agency might size the extraboard on the basis of some optimum combination of expected absence, possible callbacks of regular operators, and willingness to drop an occasional run if there is an unusual peak in absenteeism. We

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[19] J. L. Perry (1983). A study of extraboard scheduling, workers' compensation and operator stress in California public transit. Irvine, CA: University of California, Graduate School of Administration and Institute of Transportation Studies.

[20] L.C. MacDorman & J.C. MacDorman (1982). The transit extraboard: Some opportunities for cost savings. Paper presented at the Annual Meeting of the American Public Transit Association, Boston, October 1982.

found no instance of such rational planning. Rather, the extraboard swells and shrinks with changes in the service schedule and the pace of hiring and attrition. It tends to accumulate excess operators during times of service contraction and it tends to lose too many operators to regular work during times of service expansion. Moreover, there are fundamental incentives to overstaff: dispatchers have a much easier job when plenty of extraboard operators are available, and management sensitivity to customer complaints produces an attitude that missed runs are to be avoided at all cost. But greater management control of the extraboard will be difficult to accomplish. Its daily function is so complex that few managers understand the details of its operation. Indeed, the extraboard records at most agencies are not sufficient to evaluate its current functioning. There is only casual evidence for the size of the potential savings from better extraboard management, but it seems likely that it will be in the range of 1-4%, which makes it roughly comparable to what might be achieved with PTLI. This issue is worth further investigation.

Changes in work rules are an obvious way to improve labor productivity. Our research points to some changes that would have significant effects on cost. For agencies with high pay/platform ratios, an increase in the percentage of PTOs allowed will make a substantial difference, and bargaining for an increase in the maximum spread limit (up to the 13-14 hour range) is almost as effective, since it allows the scheduler more flexibility to assemble pairs of trippers into a single run. For any agency, substantial savings will result from changing the pay rules to avoid compounding of premium pay on top of guarantee pay. And on the evidence from one agency, guaranteeing FTOs a 40-hour-week rather than an 8-hour-day will produce a substantial decrease in absenteeism.

The likelihood of such substantial changes depends on the bargaining environment. Until recently, that environment has favored transit labor. It remains to be seen whether deepening transit deficits and the national shift to a "pro-management" orientation will increase the negotiating power of transit management.

In contrast to all of the previous cost-saving alternatives, service contracting is contingent upon a change in the basic role of transit agencies: instead of being the exclusive provider of transit service, they become brokers seeking the lowest cost way of assuring public mobility. Sometimes this means shedding their expensive

peak-hour services to vanpools and carpools. Sometimes it means contracting out some of their peak period service to low cost private providers.

Service contracting has attracted attention because of the magnitude of potential cost-savings. Estimated savings are 30% to 50% of transit agency costs for peak service, which makes PTLI seem inconsequential in comparison. However these estimates should be qualified. First, actual savings of this magnitude need more general documentation. Second, these savings apply to only the quantity of service which is contracted: if 10% of all service were contracted (a generously high assumption), total savings would be 3% to 5% of operating costs, or roughly double that of PTLI. Third, while service contracting provides a cost-effective option for expanding transit service (provided service coordination issues can be addressed), it is not an option for reducing costs of existing service because of difficulties with labor contracts and with Section 13(c).

If service contracting were implemented on a large scale, cost savings would be large. However, given the organizational and institutional changes which would be required for large scale implementation, as well as the practical problems of developing the private transit infrastructure, it is not a very likely alternative. Without significant federal policy changes, opportunities for service contracting are limited. While the potential benefits of "traditional" cost saving strategies like PTLI are smaller, their applicability is much wider and their likelihood of implementation is much greater.

IS PTLI APPROPRIATE FOR YOUR TRANSIT AGENCY?

First, how much money will it save? The most accurate way to answer that question is to perform an experimental runcut, taking care that all the seldom-contemplated contract restrictions are satisfied. But a good approximation to this answer can be gained by using Figure 2-1. Given your existing pay/platform ratio, and the amount of part-time labor you believe will be allowed, look at the range of savings implied by either the X's or the O's, and then lower that by about a third to allow for unanticipated implementation problems. If your FTOs have relatively standard fringe benefits and your PTOs will have relatively few benefits, then add another 1-2% to the estimate to allow for the savings in fringes.

In general, the greatest savings will occur at agencies where: (a) the work rules are markedly more restrictive than the industry average, (b) the peak/base ratio is

above 3.0, or (c) where there is a combination of moderately restrictive rules and a moderately high peak/base ratio.

Second, what are the alternatives -- control of excess absenteeism, service contracting, etc. -- and are they likely to be easier to implement?

Finally, what is it going to cost to gain the right to use PTOs? Since the actual savings from PTLI are moderate, the cost of any wage or fringe givebacks must be evaluated very carefully. Furthermore, since bargaining for PTLI will probably preclude bargaining for other kinds of contract changes, you must consider the "opportunity" cost of losing those other potential changes.

EXPANDING THE SCOPE OF PTO UTILIZATION

As PTLI has diffused throughout the industry the parameters of part-time work have become remarkably uniform: generally peak-only work, of limited duration, with weekend and extraboard assignments forbidden. The restriction to peak-only work has relatively little impact. Forbidding weekend PTO work has substantial effect on the quality of FTO work assignments, and will be discussed in the next section. What about the effect of forbidding extraboard assignments?

PTOs on the Extraboard

At CCCTA, new PTOs serve time on the extraboard before obtaining regular part-time runs. Extraboard PTOs must call in daily. If they are required to report, they receive a two hour guarantee. Overtime is paid only after 10 hours a day or 40 hours a week, and for all practical purposes, extraboard operators are ineligble for spread premium. There is no guarantee of work, either daily or weekly. The result is low dollar costs for the extraboard, but a severe degree of uncertainty regarding schedules and income for the PTOs. Accordingly, the PTO attrition rate is very high, which in turn generates higher training costs and higher accident rates because of the number of inexperienced operators.

Most agencies do not use PTOs for extraboard work; even PTO absences are covered by FTOs. This has not proven to be a major problem because the PTO absence rate is very low and PTO work can usually be covered as a tripper linked to other extraboard work. Given that the cost savings from using PTOs on the extraboard are not high, and that the savings are at least partially offset by the

costs of turnover, we conclude that expanding PTO work to the extraboard is probably not worthwhile.

PTOs for Weekend Work

The material in Chapter Three indicated that a major concern for FTOs is the availability of assignments with weekends off, and this depends on the relative proportions of weekday and weekend work available to FTOs. Thus the obvious way to help FTOs is to allow PTOs to work weekends. Such a use of PTOs has few cost saving implications for management since the weekend schedule is quite flat, but there are substantial implications for the welfare of both FTOs and PTOs. FTOs would gain more opportunities for weekends off, and PTOs would gain opportunities for more hours of work -- one tripper per day plus weekend work generates close to 30 pay hours. Weekend work opportunities might also create a larger pool of permanent part-time employees, since weekend work can more easily be combined with school or another job.

PTO Work for FTOs

The most innovative treatment of PTO work we encountered in our case study research was the option for FTOs to work PTO assignments on a temporary basis with no loss of seniority. This gives FTOs the opportunity to take a "semi-vacation" -- an opportunity rarely available to full-time workers in any field. For parents of young children, PTO work during the summer can reduce childcare needs. For people who have suffered major illnesses, a PTO stint might allow a quicker return to work. Finally, for the "burned out" FTO, temporary PTO status might provide the necessary rest and recuperation. In a sense, the increase in FTO choices and options resulting from this change offsets the decrease in choices brought about by PTLI in the first place.

PTOs gain from this innovation since more full-time work becomes available to them. And management gains from the effects of increased operator morale.

Allowing FTOs to bid for part-time work, and allowing PTOs to work weekends are changes which appear to benefit everyone -- FTOs, PTOs, and management. They merit serious consideration toward widespread adoption.

More Flexible Work Restrictions for PTOs

We noted above that PTO work restrictions are remarkably similar across transit agencies. This is probably the result of the diffusion process, whereby the earlier adopters provided the model, and later adopters copied it. Perhaps changes in the part-time job would make it more responsive to the specific needs of a given transit agency. Recall, for example, the "6 hour man" at Ottawa Transit described in Chapter One: low seniority regular operators who are guaranteed 80 hours in 2 weeks. If most PTOs are really seeking full-time work, then a "semi-full-time" position which is part of the full-time work progression might better fit the needs of the worker while still providing cost-savings for the agency.

There may also be other types of work that could be made available to PTOs in order to attract a more permanent part-time work force. School bus service and charter service are two obvious examples.

By and large, part-time labor has been a success at most transit agencies. Further evolution of the concept to better serve the needs of the agency, to attract more permanent part-time workers, and to minimize adverse impacts on full-time operators will ensure its continued success.

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APPENDIX A: CASE STUDIES

This section documents the actual experience of five transit agencies who have implemented part-time labor. Only direct effects -- service offered, schedule efficiency, and differential fringe benefits -- are considered here.

These five agencies cannot represent a statistical cross-section of all agencies; but they are a very diverse group, and illustrate a wide range of experience with part-time labor. The agencies range in size from 60 to 1100 buses; in peak/base ratio from 1.2 to 3.5; in location from long-established East North Central city to brand-new Western suburb. Two have used part-time labor to offer peaky service which would have been extremely expensive under previous work rules. One has used part-time labor to realize substantial savings in providing a more or less fixed schedule. Two others have realized smaller savings as a result of limiting factors in their operating environment.

SEATTLE METRO

Background

Seattle METRO is a large urban transit agency. It employs over 1000 FTOs and 900 PTOs, has a fleet of about 1100 buses, and serves a metropolitan area with a 1980 population of 1.6 million. The transit system is a department within the region's Metropolitan Council, a county-level agency which operates the water and sewer system as well as the transit system.

Seattle METRO assumed countywide transit operations in 1972 as part of a comprehensive transit plan approved by voters. The plan also included a .3% dedicated sales tax, a bond program for transit capital improvements, and a 1% annual excise tax on private motor vehicles registered in the county. The excise tax was earmarked for debt service, with any remainder available for the operating deficit. Approval of this plan demonstrated substantial public support for transit service improvements. Implementation was quite rapid: measured in vehicle hours, 1976 service increased by 20% over 1973 levels; by 1980 the increase was over 50%. Public support was again demonstrated in the 1980 election, when the cap on the sales tax was increased to .6%. The state legislature also cooperated by making the vehicle excise tax permanent. These actions assured the agency a stable local revenue base which would increase with inflation.

Basic operating statistics for 1977 through 1982 are presented in Table A-1. Seattle METRO's record of attracting ridership is impressive. It is one of the few areas in the U.S. where ridership per capita increased over the decade: from 27 trips in 1972 to 55 trips in 1981. Peak period service expansion was very much a part of this ridership growth.

TABLE A-1
SEATTLE METRO OPERATING STATISTICS, 1977 THROUGH 1982

	1977	1978	1979	1980	1981	1982
Operating Expenses	$43.072	51.330	65.263	85.416	96.808	107.631
Ridership	44.903	49.461	58.259	66.059	67.0	79.68
Rev. Veh. Hrs.	1.81	1.88	2.01	2.27	2.20	2.34
Farebox Recovery	26%	27%	34%	33%	29%	N/A
Cost/Pass	$.96	1.04	1.12	1.29	1.44	1.35

Source: For 1977-1981, Seattle METRO Annual Reports; for 1982, UMTA Section 15 data. Cost figures are actual dollars.

Part-time Labor at Seattle METRO: Background and Overview

The principal motivation for adopting part-time labor at Seattle METRO was the desire to fulfill an ambitious ridership goal for 1980 which had been adopted as part of the comprehensive transit plan. By 1977, the district was far short of this goal, despite consistent ridership increases. This was of concern not only because of the implied shortfall in meeting transit demand, but, more pragmatically, because the district was preparing a long-range plan for 1990. Approval of that plan was seen as contingent upon success in meeting the existing ridership goal. It had become clear that the 1980 goal could only be reached by a massive expansion of peak service and, since staffing such extra service would be prohibitively expensive under existing work rules, management felt that PTLI was necessary.

Seattle METRO was the first major U.S. transit district to implement part-time labor. The "price" of PTLI, in bargaining concessions, consisted of the abolition of a two-day waiting period for sick pay. The settlement, however, allowed more liberal use of PTOs than has been achieved by any major U.S. contract since: the agency was permitted to hire as many PTOs as FTOs, whereas most contracts now in effect limit PTOs to between 10% and 15% of FTOs.

Management tried to rapidly build up the part-time force while diffusing opposition. Retired FTOs were actively recruited for part-time positions, on the theory that they would be more readily accepted by the existing force, and the number of full-time positions actually increased during the first eighteen months of the new contract. Management maintained a policy of assigning only one tripper per PTO, though it had the right to assign two. This policy had two purposes. First, it was felt that a single tripper assignment was more in keeping with the image of part-time work: a two tripper assignment, for which the PTO would receive neither spread premium nor makeup pay, might too closely resemble an underpaid full-time split run, which would make PTOs look like "second-class" workers. Second, the single tripper policy effectively doubled the recruitment rate for PTOs, boosting the proportion of part-time supporters in the union. When contract talks reopened in 1980, a substantial proportion of the union consisted of PTOs.

Evolution of the Part-Time Contract

The 1981 contract improved the PTO position by increasing the time-per-tripper guarantee from 1:30 to 2:20. In addition, a mid-contract

renegotiation in June 1983 significantly improved the PTOs status. The occasion of the renegotiation was an agreement by the transit district to take over school bus services. This provided a natural role for PTOs, and they were offered the option to bid on two-tripper daily assignments -- essentially abbreviated split runs. These assignments carried a five hour guarantee and paid a spread premium after twelve hours' spread.

At the same time, all PTOs were given the option of bidding for a tripper to be worked in addition to their regular assignments; FTOs, however, were given first pick of potential trippers. Finally, and probably most important, sick leave was granted to all PTOs. This provision was prompted by "horror stories" of operators who worked despite their sickness or injuries because they could not afford to miss a day of work. A much publicized example concerned a driver who stoically removed a cast from his broken arm and proceeded somehow to drive his shift.

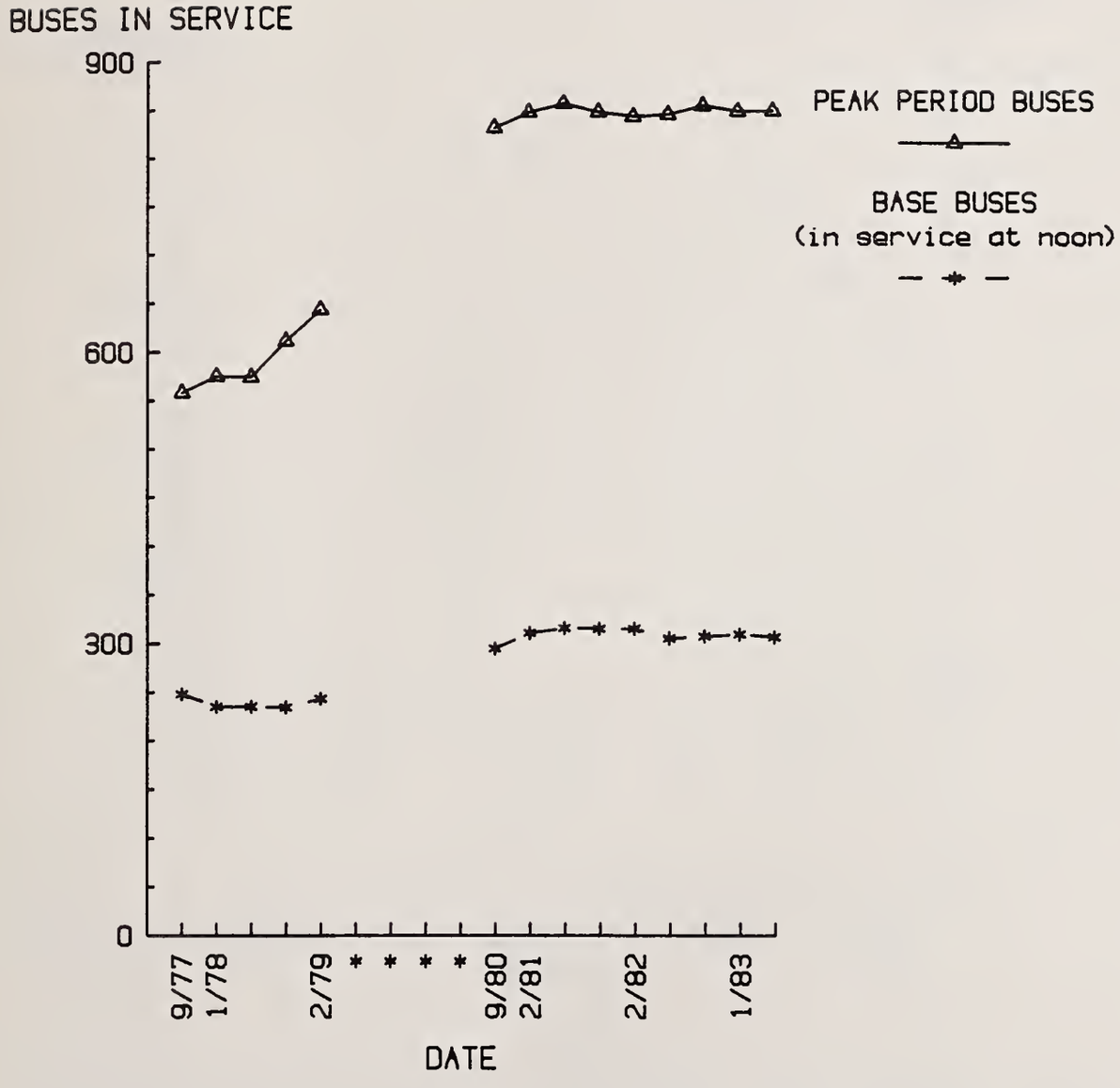
As of the 1984 contract, PTOs are now allowed to cover PT absences. In effect, there is now a PT extraboard. Also, beginning in 1986, PTOs will accrue vacation benefits. At the same time, most PTOs will be given two-tripper assignments. The result of all these changes is that the PT position is becoming very much like the full-time position, but with a much smaller pay guarantee and a more generous spread threshold.

The 1984 contract also continued the trend of reducing overtime work for FTOs: the number of guaranteed FTO trippers was reduced from 72 to 55. In return for this loss, the number of guaranteed FT runs will increase incrementally to 700 in 1987.

Impact of PTLI on Service Schedule

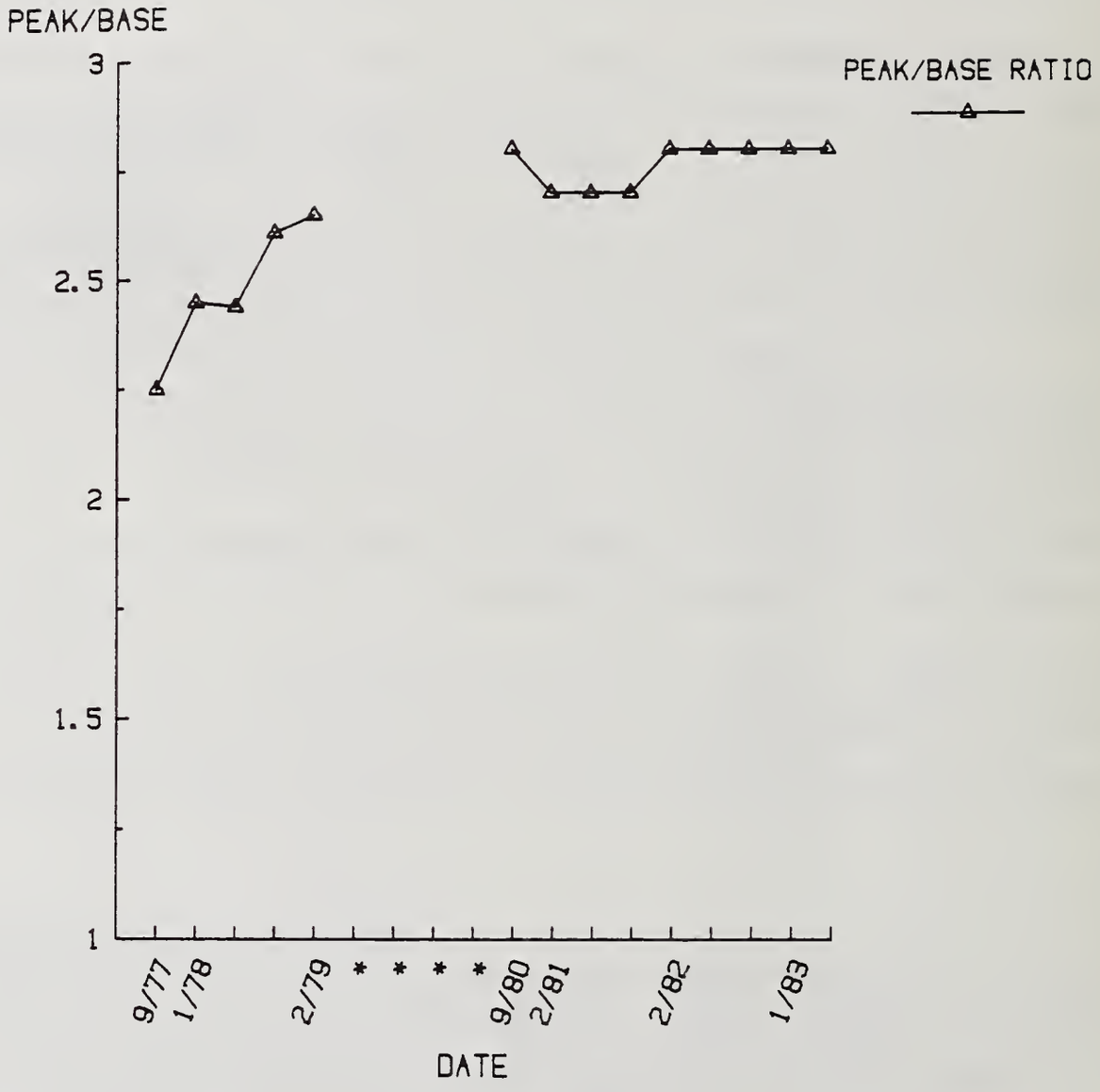
The plan of using PTOs to increase peak service was executed rapidly (Figure A-1). During the first year of PTLI, the number of buses in peak service rose by 15%, while base service buses remained approximately constant. The peak/base ratio increased from 2.25 to 2.65 (Figure A-2). Service continued to expand over the next two years, stabilizing by 1981 with platform hours about 40% above the pre-PTO level (Figure A-3). This was accomplished through a 52% increase in peak hour vehicles coupled with a 25% increase in midday coaches. The resultant peak/base ratio was about 2.8.

FIGURE A-1
WEEKDAY PEAK AND BASE SERVICE



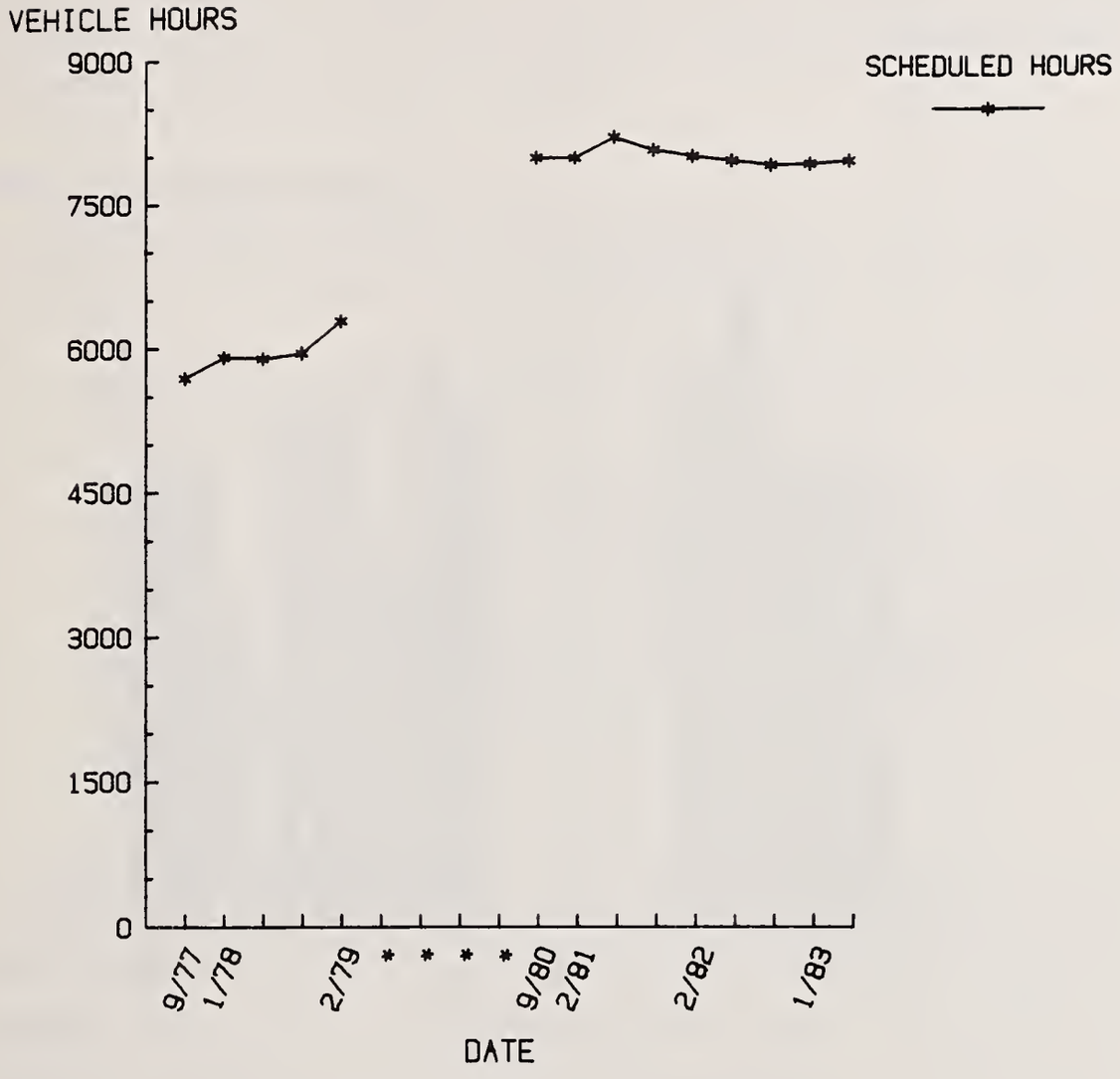
*Data Not Available

FIGURE A-2
PEAK TO BASE RATIO



*Data Not Available

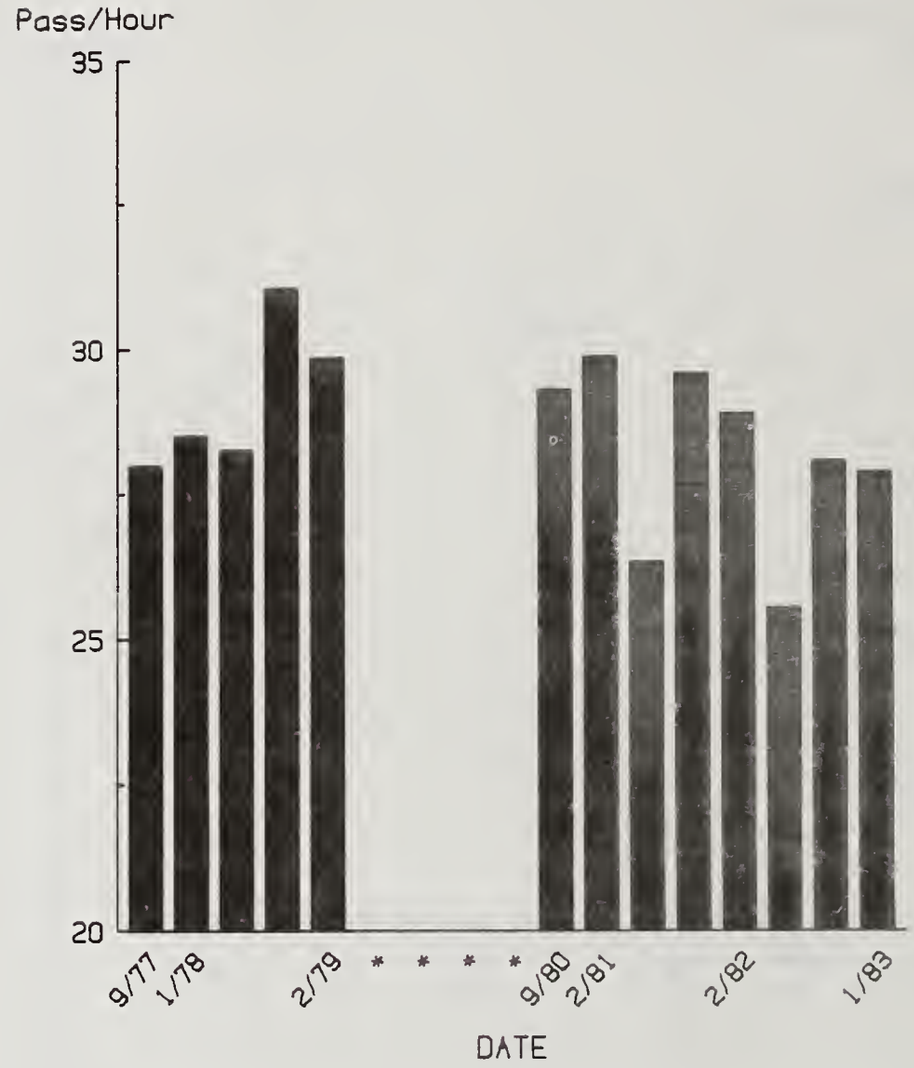
FIGURE A-3
SCHEDULED WEEKDAY VEHICLE HOURS



*Data Not Available

The service expansion reaped a proportionate gain in ridership. Initially, in fact, the average number of passengers per platform hour increased, indicating that the newly offered peak service was tapping latent demand. As additional service was added, vehicle occupancy declined to pre-PTO levels, but not below (Figure A-4). Thus, total ridership increased substantially.

FIGURE A-4
PASSENGERS PER PLATFORM HOUR BY SHAKEUP



* Data Not Available

Effects on Driver Assignments and Staffing

The 1977 agreement put Seattle METRO's runcutters in unexplored territory. The theory and practice of runcutting had evolved in the context of an exclusively full-time driving force. No procedure existed, at this agency or elsewhere, for scheduling large proportions of work to PTOs.

Runcutting practice is still adapting to the new environment. The procedure is first to use automated systems to cut straight runs, with an eye toward producing a

large number of leftover, tripper-length pieces. These pieces are largely assigned to PTOs. Manual fine-tuning assures that the contractual floor for FT runs is met while making trippers available to all PTOs. The runcutters speculate that a completely revised, nontraditional approach to runcutting might be fruitful, but extensive experimentation has not been done.

Impact on Schedule Efficiency

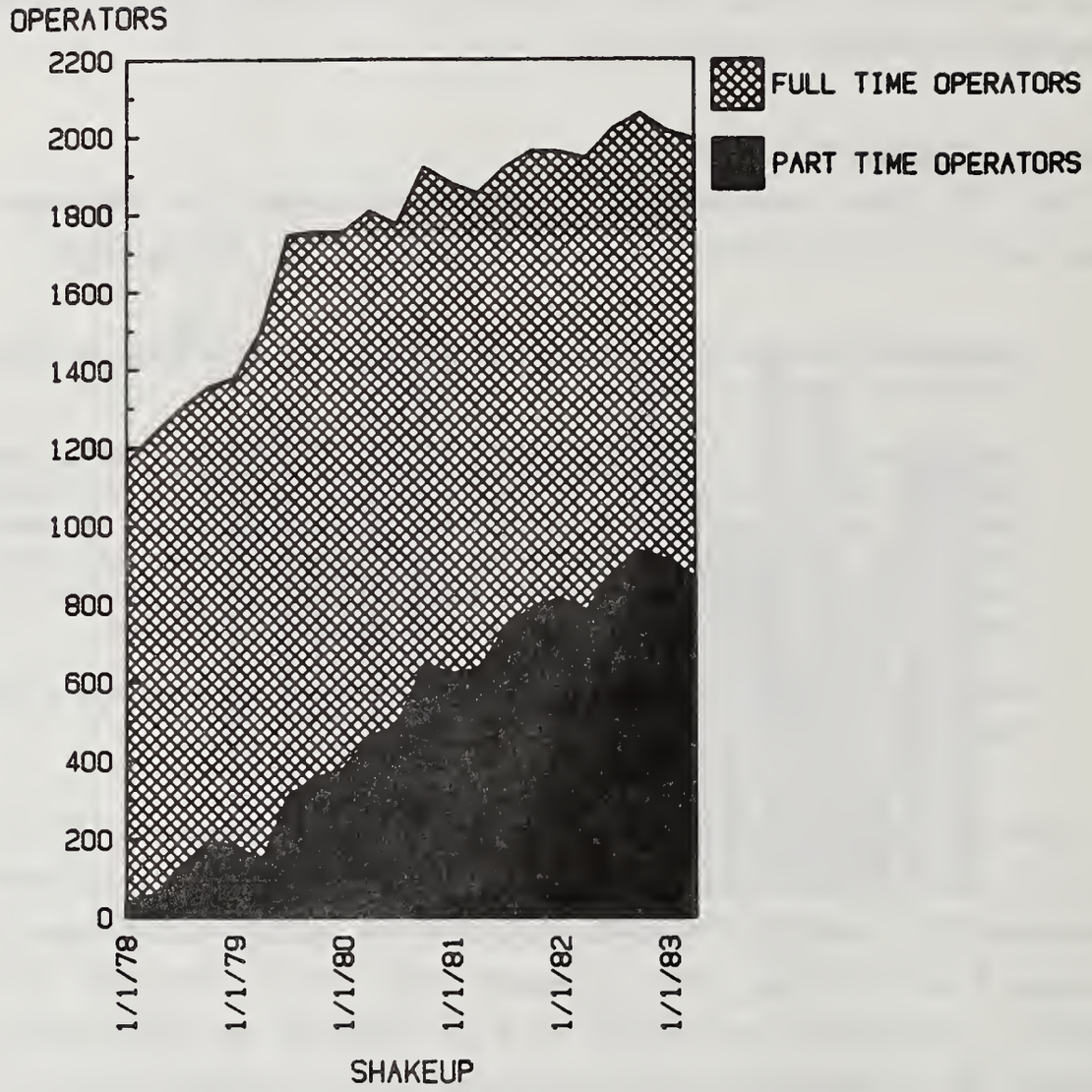
The 1977 labor contract set a national precendent for subsequent PTLI agreements in its provisions to protect the incumbent FTOs. The contract:

- Established the prevailing number of regular runs as a floor on the number of runs available to FTOs.
- Established a floor for the number of FTOs themselves. While somewhat less than the actual number of operators on the staff at the time of the contract, the floor could only be reached through attrition. To ensure that FTOs are not displaced by PTOs the contract specifies that FTOs terminated for disciplinary reasons must be replaced by another FTO. At least 100 FTOs were to be hired during the life of the contract.
- Reserved 60 (later 72) biddable trippers for FTOs, as a source of overtime earnings.

These provisions have largely remained intact in the subsequent 1981 and 1984 contracts. Figure A-5 summarizes the actual history of driver assignments at Seattle METRO. The 1978-79 service expansion was initially accomplished using an increased force of FTOs: FTOs increased from 1126 in late 1977 to 1435 in mid-1979. Thereafter, the number of FTOs declined, as PTOs were rapidly recruited. By the beginning of 1983, full-time staffing had fallen to the 1977 level, while the number of PTOs had climbed to 80% of the FTO level.

While both peak and base service increased, the number of full-time runs was maintained at or near the contractual minimum. This was done by shifting FTOs from peak service to base service, while assigning both old and expanded peak service to PTOs. Thus, between September 1977 and June 1983, the number of full-time split runs declined by 67, but the number of straight runs increased by 66. Meanwhile, the number of scheduled trippers exploded, increasing by 764 over the

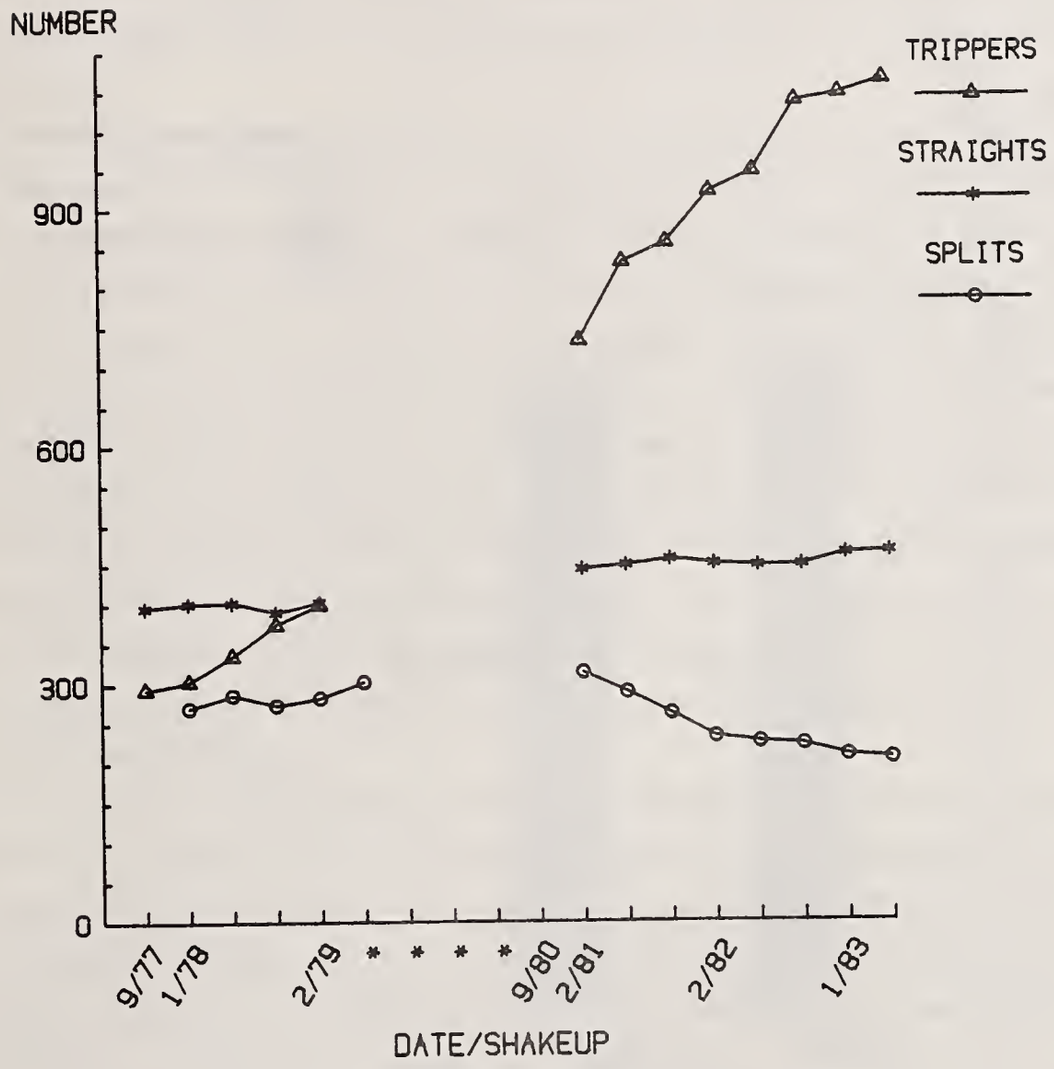
FIGURE A-5
NUMBER OF OPERATORS
(PTOs and FTOs by Shakeup)



same period (Figure A-6). This is approximately the number that would be generated by "cannibalization" of the 67 split runs, together with the additional 288 vehicles per peak period.

The decline in scheduled split runs -- from 41% of all weekday runs to 31% -- reduced the number of highly desirable full-time assignments for two reasons. First, split runs, on the average, pay 15% more than straight runs and require

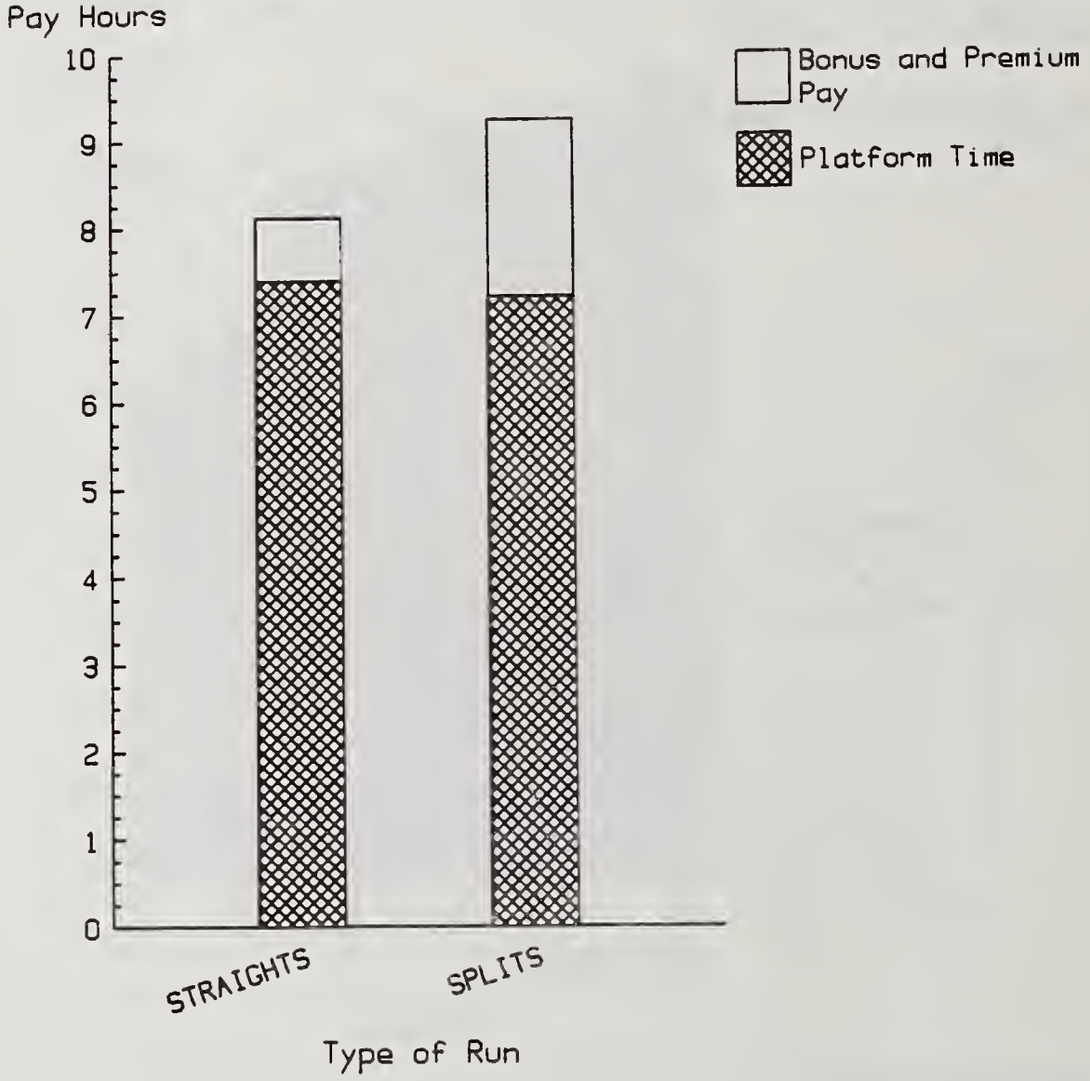
FIGURE A-6
STRAIGHT RUNS, SPLIT RUNS AND TRIPPERS
(Scheduled Weekday Service)



*Data Not Available

slightly less actual driving time (Figure A-7). Second, many drivers consider splits to be less stressful than midday or evening straight runs. While split runs generally involve heavier traffic, they serve a more stable, well-behaved group of passengers. On sparsely populated midday runs, a difficult passenger can be a headache, and there is more danger from criminals. By contrast, a packed bus of commuter "regulars," familiar with the operator, can deter or control antisocial behavior.

FIGURE A-7
SPLIT RUNS PAY MORE THAN STRAIGHTS
(Scheduled Weekday Runs, September 1977)



The recent shortening of long-straight runs, thus eliminating overtime payments has also reduced the number of high-paying runs. Not all operators value the premium payments as compensation for the burden of long hours. But for those who do, the loss of splits and long-straights represented a decrease in expected income.

A related source of concern for FTOs was a perception that PTOs were crowding them out of desirable Monday-through-Friday assignments. At the heart

of the issue is a fundamental scheduling problem: someone has to drive the weekend runs, but most operators would prefer not to. Senior operators usually bid for Saturday/Sunday-off, leaving their juniors with less desirable days off. PTOs, however, are not permitted to work on weekends. To the extent that PTOs displace FTOs from weekday work, an FTO perceives a reduction in his chances of getting weekends off.

Are these perceptions justified? The issue is confused by an 1980 change in scheduling practice. Prior to 1980, all weekend work had been handled by extraboard operators. Adoption of the current seniority-based pick system shifted much of the burden of weekend work away from extraboard operators to regular FTOs. The regular FTOs' chance of a free weekend thus drastically decreased at the same time the PTO recruitment was booming, but for independent reasons.

Scheduling regular days off is sometimes seen as an arcane process, but the FTOs prospects for a weekend off are easily calculable. The number of weekend runs (including extraboard positions) determines the absolute number of drivers who must work weekends. Thus the introduction of PTOs on weekdays cannot directly affect the absolute number of weekend-off assignments. It is the ratio of FTO-weekend runs to FTO-weekday-runs that governs the proportion of FTOs who must accept weekend work.

While records of assigned days-off are not available, we do know the number of weekend runs, weekday runs, and total full-time staff. The proportion of all regular runs falling on the weekend hovered at approximately 0.20 during the entire part-time era. The ratio fell to 0.18 during 1979, but never exceeded 0.21. This ratio does not factor in extraboard assignments, so it only allows us to conclude that PTLI affected neither the number nor proportion of regular FTOs receiving weekends off. Since the total number of runs stayed constant over this period, the fluctuations in total number of FTOs (Figure A-4) reflect variations in extraboard staffing. Comparing June 1983 to September 1977, the number of FTOs is virtually unchanged, so that FTOs weekend chances must also have remained unchanged over that period. A mid-1979 baseline gives a different picture, however. As noted before, there was a brief expansion in full-time positions to staff the newly-augmented peak service. That expansion peaked in 1979, and the new recruits were primarily extraboard operators with weekday assignments. Since that date, the proportion of all FTOs who can receive weekends off has declined to pre-PTLI levels -- but not below.

We conclude that PTLI did not impair the FTOs objective chances of securing work-free weekends. However, subjective perceptions may be drastically different. If the peak service added during 1978-79 had been staffed by FTOs rather than PTOs, an FTOs chances of receiving weekends off would have been greatly increased. It is this comparison which may be generating the FTOs' feeling of deprivation.

Impact on Schedule Efficiency

Despite the increase in peak/base ratio between 1977 to 1983, the ratio of pay hours to platform hours dropped by 5%, declining to about 1.14 from the pre-part-time level of 1.20. Most of this savings represents a dilution effect. The service added since 1977 was relatively cheap, since it consisted of peak service assigned to PTOs, and base service which would be incorporated into straight runs. The new service can therefore be assumed to have a pay hour to platform hour ratio close to the minimum possible, about 1.06. (The minimum pay/platform ratio exceeds unity because of payments for report and travel time.) Averaging in this new, efficient service with preexisting service drops the pay/platform ratio to 1.16. The remaining 0.02 point drop in pay/platform ratio is attributable to the use of part-time labor to operate the pre-existing service.

Conclusions

Seattle METRO significantly expanded peak service while cutting average labor costs. This statement, we feel, is a more meaningful summary than a simple calculation of savings attributable to PTLI. The problem with such a calculation is choosing the baseline against which the savings are to be calculated. For example, it would be very expensive to operate the 1983 service schedule with FTOs working under 1981 contract rules: relative to that hypothetical situation, current practice saves about 9.7%.[20] However, without part-time labor, it is very unlikely that management would have adopted the 1983 schedule. And even if the 1983 peak/base ratio were maintained, a schedule solely dependent on FTOs would probably have

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[20]Urbitran Associates, Inc. (1982). Transportation Systems Management: Implementation and Impacts. Case Studies. Washington, DC: U.S. Department of Transportation, Urban Mass Transportation Administration, Office of Planning Assistance. (DOT-I-82-59).

longer trippers than are currently found; moreover, it is very likely that the union would have acceded to a wider spread premium threshold to avoid PTLI.

For the incumbent operators, PTLI had a generally negative impact, by decreasing the availability of high-pay, low-driving runs. The union was forced to assimilate a large new group whose interests diverged from, or even conflicted with,those of the older drivers. There was, however, no net loss of full-time positions, and almost a thousand part-time jobs were created.

A latent problem is that most of the newly-recruited PTOs would prefer full-time employment. While no reliable survey data exist, the most optimistic management spokesperson guessed that only thirty-five to forty percent of PTOs genuinely want part-time positions. A union official guessed the proportion at twenty percent. It seems safe to say that a majority of PTOs view their job as a temporary steppingstone to a full-time position. The importance attached to graduation out of PT status is reflected in a union-demanded provision of the 1981 contract which guarantees that eighty-five percent of new FTOs will be recruited from the part-time ranks. If FTO turnover declined, this opportunity for advancement would diminish, with possible negative effects on morale or recruitment of PTOs. Indeed, recent agency reports (1984) indicate that low FT turnover rates are causing morale problems among the PTOs. Recruitment may also be affected by the current economic upturn. Seattle METRO's success in recruiting large numbers of PTOs has been accomplished during a period of high unemployment. As full-time employment opportunities burgeon, it will become harder to attract and hold the reluctant part-timers who have pioneered this experiment in providing low-cost peak service.

OCTD

OCTD is a medium-sized operation with approximately 500 buses providing 4000 hours of daily service. It serves a sprawling, medium-density, auto-dependent suburban county. The district was formed in 1972 and took over the pre-existing local city system of about 20 vehicles. It is one of several transit districts formed in the rapidly growing region in the early 1970's. The impetus was state legislation which earmarked a 1/4 cent gasoline sales tax for transit.

The PTO implementation plan at OCTD did not enlarge peak service (in contrast to Seattle METRO and TRI-MET). Rather, an effort was made to distribute service as evenly as possible throughout the service area. Consequently, the peak/base ratio is quite low, approximately 1.2. Transit service expansion during the 1970's was rapid. In 1973 there were 50 peak buses; by 1980 there were over 400 peak buses and an additional 100 small buses providing dial-a-ride service. Table A-2 gives operating statistics for selected years. OCTD did not experience more than proportional gains in ridership from its service expansion, probably due to the dispersed travel patterns it attempted to serve, and due to its emphasis on low productivity dial-a-ride service. As a result, the agency has been highly dependent

TABLE A-2
OCTD OPERATING STATISTICS, SELECTED YEARS (ENTIRE SYSTEM)

	FY 74-75	FY 77-78	FY 80-81	FY 82-83
Revenue Vehicle Miles	6,300	16,463	19,849	19,314
Passenger Trips	7,953	19,410	29,443	28,417
pass/mi.	1.26	1.18	1.48	1.47
Fare Revenue	1,457	3,097	10,021	17,400
Operating Expense	$8,589	$23,118	$55,257	$69,494
Farebox Recovery	.17	.13	.18	.25
State Sales Tax Revenue	$8,727	$7,298	$24,277	$47,663
UMTA Sec. 5 Rev.	3,771	9,471	19,982	11,800
Local Prop. Tax Rev.	2,779	3,429	2,303	3,368

Source: OCTD Annual Reports and budget data; actual dollars; all numbers in 1,000's.

on subsidy revenues. Farebox recovery did not reach the state-mandated 20% until 1981. While subsidies were plentiful in the early years, they did not keep pace with the increase in operating expenses. Thus by 1978, cost containment had become a primary consideration.

PTLI at OCTD

In 1978, OCTD was not an obvious candidate for PTLI. By industry standards, its spread rules were quite favorable to management. Regular operators were not eligible for a spread premium until 12 hours; for extraboard operators, the spread premium threshold was 13 hours. There was no statutory maximum spread limit. These comparatively lenient rules, and an established tradition of letting regular drivers bid on short trippers, made it relatively inexpensive for the agency to operate short pieces of work. Because of the long spread threshold, there was little occasion for the payment of spread premiums. The regular drivers' enthusiasm for biddable trippers obviated the necessity for extensive make-up payments. Moreover, the very low peak/base ratio sharply limited the number of trippers on the system. The immediate payoff to PTLI was therefore very small in 1978.

Nonetheless, management pressed vigorously for PTLI during the 1978 contract negotiations. A board of arbitrators awarded management the right to employ PTOs up to a limit of 5% of the number of FTOs, beginning in December 1979. The contract, however, did not clearly distinguish a class of assignments that could be worked exclusively by PTOs, and another arbitration board subsequently ruled that all trippers could potentially be bid by FTOs, to be worked in conjunction with their regular assignments. The FTOs proceeded to exercise this right, bidding for virtually all available trippers. This effectively blocked PTLI for the remainder of the contract period.

A new contract took effect in December 1980, following what management describes as an "issueless" strike. The new contract defined as "biddable" all trippers of less than 2.5 hours' length. Longer trippers were reserved for PTOs or the extraboard. The limit on the number of PTOs was relaxed to 10% of the number of FTOs, effective February 1982. PTOs were restricted to no more than one assignment daily, with a maximum length of five hours. The 1980 contract also gave PTOs the same fringe benefits as FTOs: proportional holiday pay and vacation; full sick leave; and health insurance.

The scheduling department moved with deliberate graduality to introduce part-time assignments. The June 1981 shake-up was the first to incorporate PTOs; 14 part-time positions were scheduled. The apogee of part-time utilization was the September 1982 shake-up, which included 39 part-time positions. This represented 5% of the full-time force, only half of the permissible part-time limit.

The part-time experiment was aborted by a 5% service cutback in the February 1983 shake-up. The contract specified, then as now, that FTOs could not be laid off until all PTOs were furloughed and, as such, the brunt of the cutback fell on the PTOs. All 26 remaining part-time positions were eliminated, and the trippers formerly worked by PTOs were assigned to the extraboard. The extraboard was increased to handle this work. Nonbiddable trippers continued to be created: the intent was to keep all types of work assignments to preclude any conclusion that certain types of work were no longer necessary.

Effect of PTLI on Service Schedule

As reported above, OCTD's managers reported that PTLI was not motivated by a desire to increase the peak/base ratio. This is dramatically confirmed by a decline in peak/base following part-time adoption. The peak/base ratio declined from a value of 1.4 in February 1981 to 1.2 in June 1982, where it has held approximately constant since (Figure A-8). The decline was effected by an increase in base-service buses while the number of peak buses remained constant. (Figure A-9). But despite the increase in base buses, total vehicle-hours of service remained fairly constant (Figure A-10), suggesting that very early and late service was cut back in order to boost midday base service. The general cutback in service, mentioned in the previous section, began in December 1982 with a 3% cut in vehicle hours and accelerated in February 1983, with an additional 5% cut.

Changes in driver assignments

There are four principal categories of driver assignment at OCTD:

Straight run: usually a one-piece run; sometimes two-piece, with a short paid break. The contract provides that at least 50% of all runs must be straight runs.

Split run: two-piece run, with an unpaid break. The contract mandates that if two pieces of work totalling at least seven platform hours can be paired, they must be slated together as a split run, rather than placed on the extraboard.

Bid tripper: short (less than 2.5 hour) piece of work, operated by a volunteer regular FTO before or after a regular run. The operator does not receive a spread premium, but the tripper is paid at overtime rates, with a minimum payment guarantee of two hours. The operator's total daily platform time cannot exceed ten hours, however.

Unbid trippers: either a tripper longer than 2.5 hours, or a biddable tripper for which no one volunteered. Some of these trippers are operated by PTOs. These tend to be 3.5 to 4 hours in length. Remaining trippers are assigned to the extraboard. Traditionally, a morning and an evening tripper would be paired as a "combo", and assigned to an extraboard operator. Since February 1983, combos may be split up, and many extraboard operators are assigned a run in conjunction with a tripper.

Two contract provisions reveal union concern that PTLI might decrease the number of FTOs, or reduce their earning capacity. First, the contract sets a cap on the number of part-time drivers, and requires that all PTOs be dismissed before any FTO is laid off. Taken by itself, though, this provision would permit winnowing the full-time force by attrition. Second, the contract specifies that "runs being worked by full-time Coach Operators on February 8, 1981, shall not be modified in order to create trippers for part-time operators." This provision is apparently intended to prevent schedulers from "cannibalizing" split runs by breaking them up into part-time assignments. As a practical matter, though, the provision is difficult to interpret or enforce, due to the fluid character of the runcuts. The runcutting process tends to drastically reshuffle driver assignments each shakeup, so that many if not most of the runs in existence on February 8, 1981, no longer existed a few shakeups later. It would be impossible to demonstrate that a particular split run had been cannibalized for the specific purpose of creating trippers. Hence this contract provision is not literally enforceable. However, a drastic decrease in the number of split runs, coupled with an increase in trippers, would probably provoke union objections. Partly for this reason, PTLI proceeded at a leisurely pace.

Given the obvious concern with driver assignments embodied in the contract, it is of great interest to look at the effects of PTLI on the assignment mix. To assess the impact of PTLI we will compare the June 1981 shake-up--the first to use PTOs--with the September 1982 shakeup, which represents the zenith of part-time utilization at this district. Fortunately for our analysis, the two periods were

FIGURE A-8
PEAK/BASE RATIO BY SHAKEUP

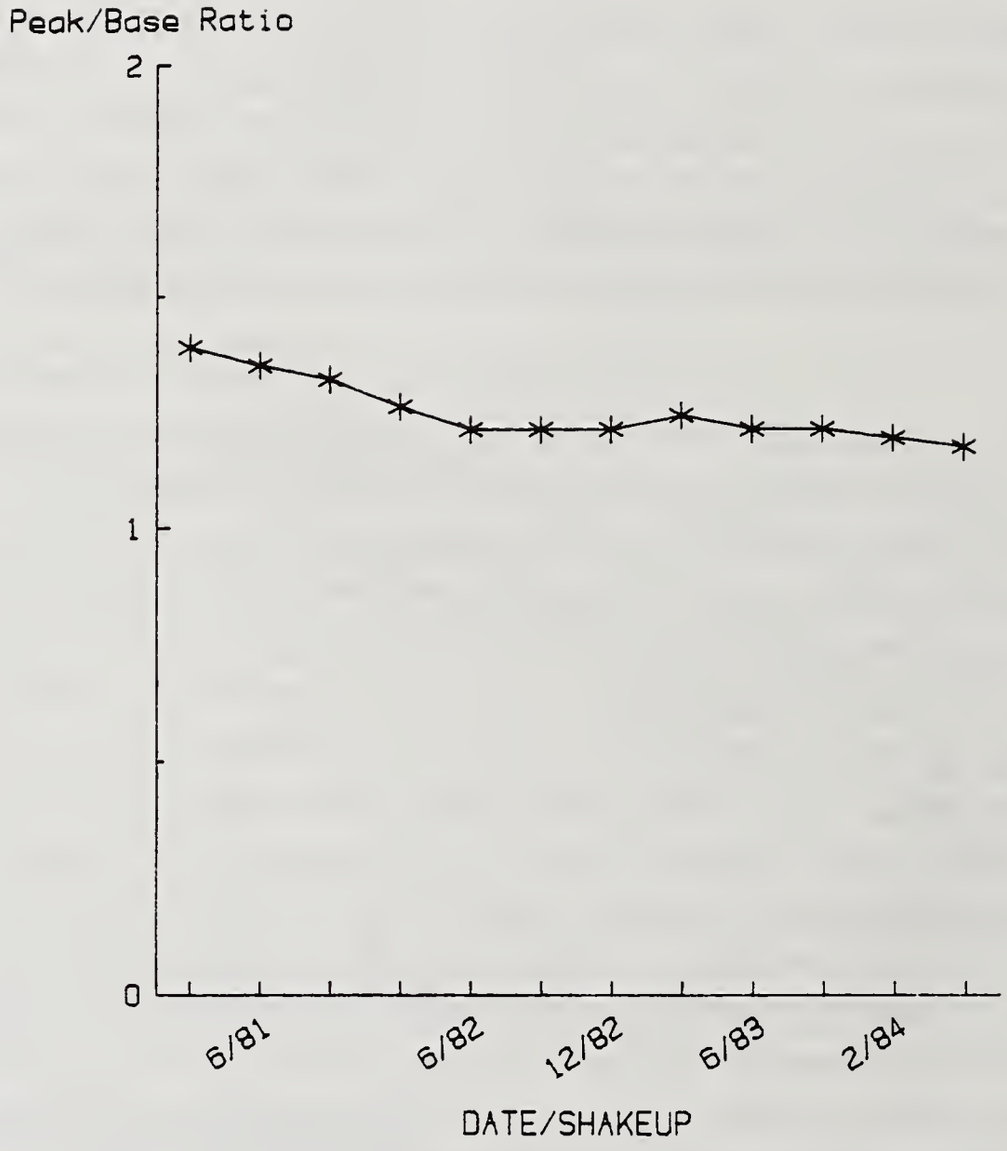


FIGURE A-9
WEEKDAY PEAK AND BASE SERVICE BY SHAKEUP

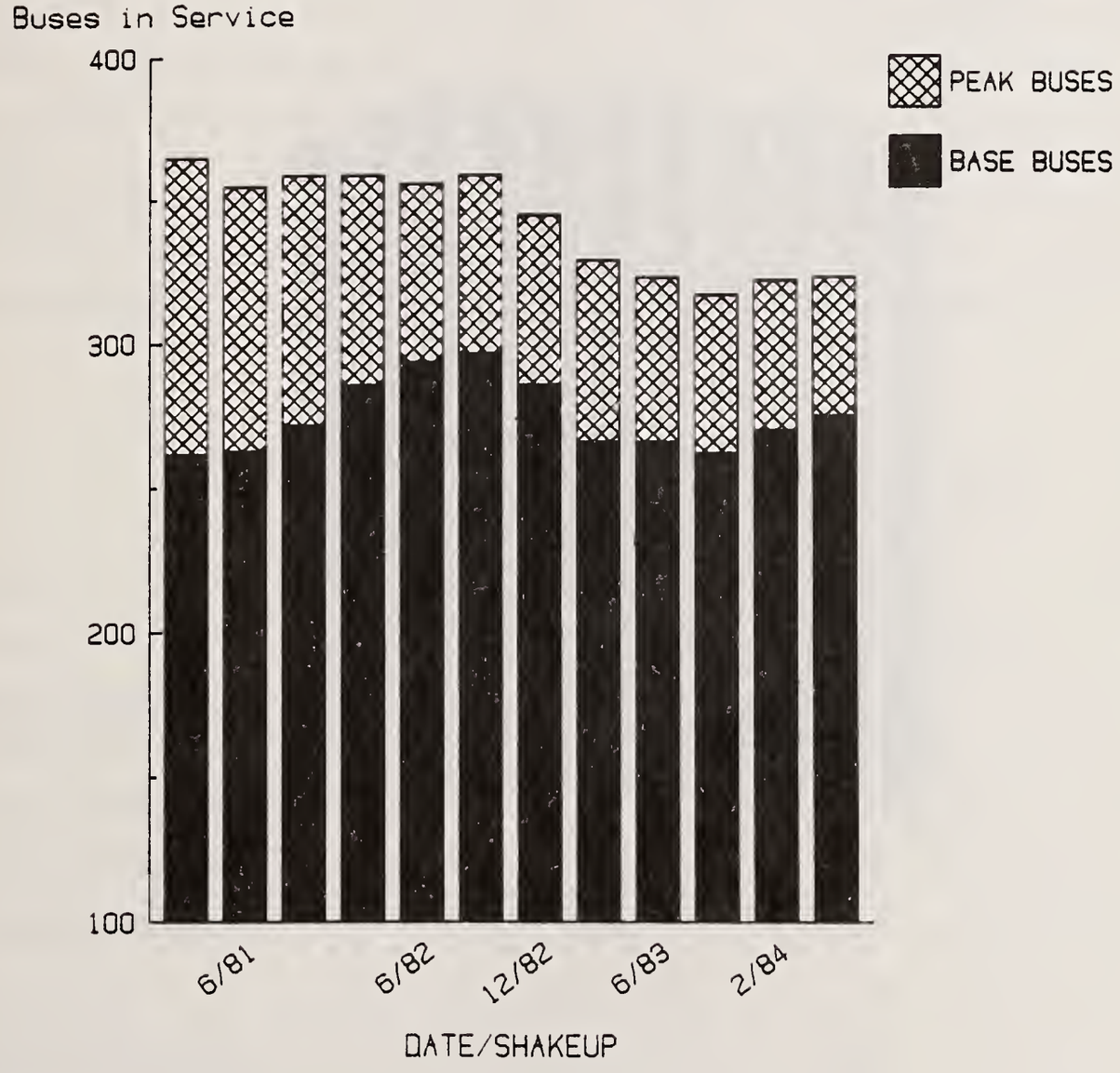
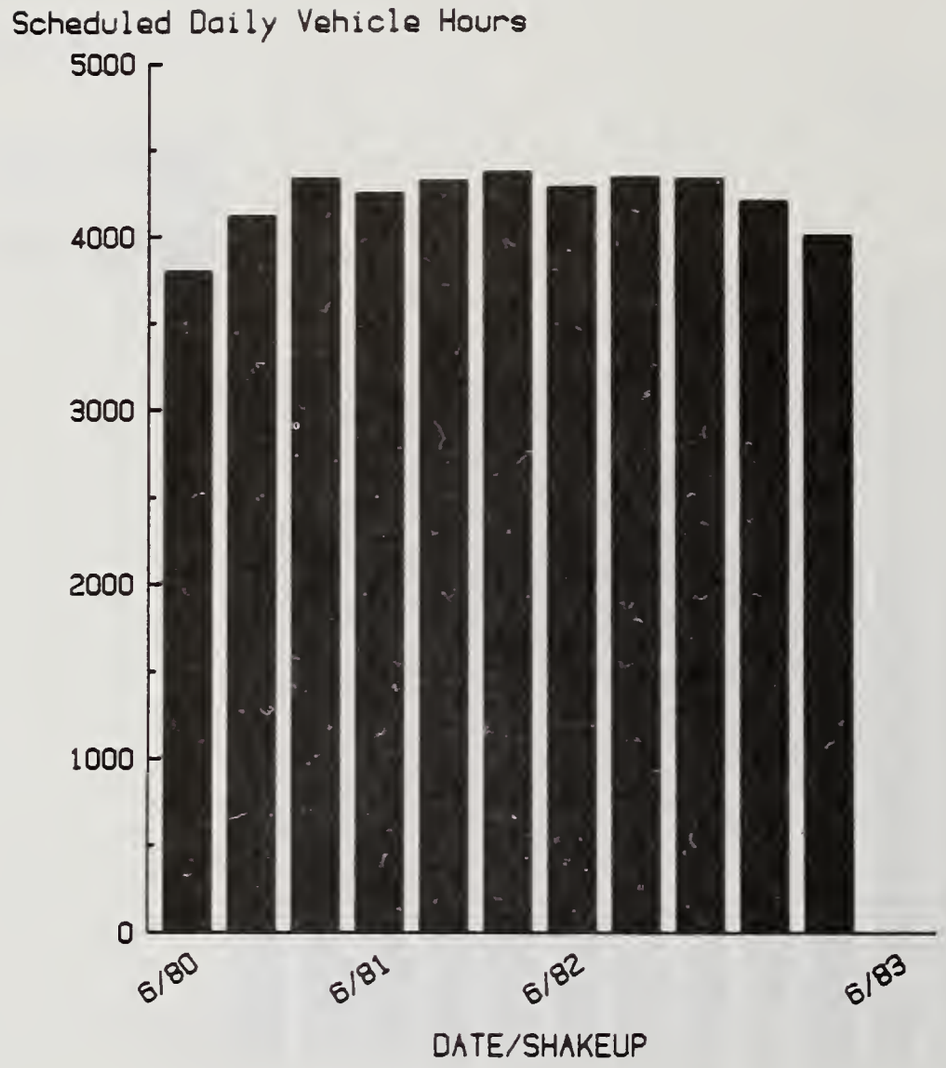


FIGURE A-10
WEEKDAY VEHICLE HOURS



characterized by identical work rules, identical runcutting procedures, and virtually identical aggregate service levels. The only important differences between the two shake-ups are: (1) the increased utilization of PT labor; and (2) the previously-noted decline in peak/base ratio.

Between the two benchmark shake-ups, part-time runs increased from 14 to 39. At the same time, the number of split runs decreased by 32, while 23 straights were added. Thus there was a net loss of nine full-time positions, about 1.7% of all regular runs (Table A-3).

These changes do not seem to indicate cannibalization of preexisting runs by part-time scheduling. Rather, the shift to a lower peak/base ratio is responsible for the loss of split runs and the slight decline in full-time positions. As noted previously, base service was boosted during this period, while peak service held constant. This would automatically tend to decrease the ratio of splits to total runs, since splits are generated primarily by the excess of peak buses over base buses (Figure A-9). As base service expanded, this potential source of split runsdiminished. In June, 1981, the ratio of (peak buses - base buses)/total runs stood at 17.1%; by September 1982, the ratio had declined to 11.9%. This is consistent with the observed 5 percentage point decline in the ratio of split runs to total runs.

TABLE A-3
EFFECTS OF PTLI ON STAFFING AND ASSIGNMENTS

	June 1981	Sept. 1982
Regular runs	539	520
% split runs	27.8%	22.7%
Biddable trippers regular runs	5.2%	5.4%
Av. pay, all reg. runs	9:08	9:31
Av. pay, straight runs	8:53	9:08
Av. pay, split runs	9:47	10:49
Trippers on EB	0	0
Trippers worked by PT	14	39
PT drivers All regular operators*	1.8%	5.0%

*Includes EB; operators who work on weekends

Another difference between the two shakeups is that regular runs in September 1982 averaged about nine minutes longer in platform time than the June 1981 runs. This may reflect a deliberate attempt to reduce the number of runs, or it may simply be a consequence of service changes. In any case, lengthening 520 runs by an average of nine minutes is sufficient to absorb 78 hours of platform time. This is the equivalent of nine or ten full-time runs, suggesting that the observed decline in the number of operators is due to runcutting strategies unrelated to the adoption of part-time labor.

Not only were runs slightly longer, they were also slightly better paid. Runs in September 1982 averaged 23 pay-minutes, or 4.2%, more than in June 1981. Split runs, though fewer, were substantially more lucrative in September 1982, with an average gain of over one pay-hour. This gain resulted from substantially longer platform times for split runs; the pay/platform ratio declined by 0.34%.

In sum, schedule data suggest that part-time operators were used to augment service rather than displace full-time operators. The observed decrease in the ratio of splits to straights is attributable to a shift towards less peaky service, and the slight decrease in the number of full-time drivers is explicable entirely by a slight lengthening in the average platform length of runs. This lengthening may reflect a deliberate strategy to reduce the number of operators, but such a strategy is independent of PTLI.

Changes in Service Efficiency

Between the two benchmark periods, service efficiency (defined here as the ratio of pay hours to platform hours) improved slightly, as the ratio dropped from 1.195 to 1.176. This represents a per-platform-hour savings of 1.6%. Credit for this savings must be apportioned between two efficiency-increasing innovations: (1) the reduction in peak/base ratio; and (2) the expansion of part-time labor. The relative contributions of the two innovations can be estimated only roughly, because of their rather complex interaction: had peak/base not decreased, part-time labor would have yielded greater savings. Nonetheless, we can put approximate bounds on the magnitude of savings from each of the two innovations.

As we have seen, the reduction in peak/base ratio boosted the ratio of straights to splits. Since straights tend to have a lower pay/platform ratio, a shift from splits to straights will automatically boost schedule efficiency. On this basis, we estimate

that the decrease in peak/base ratio resulted in per-platform hour savings of 0.4% to 0.7% (Table A-4).

TABLE A-4
CALCULATION OF SAVINGS DUE TO CHANGE IN PEAK/BASE RATIO

We have the following data:

	June 81	Sept. 82
Fraction of reg. runs which are straights (Z)	.722	.773
Av. pay/platform, straight runs (R_{str})	1.1451	1.1877
Av. pay/platform, split runs (R_{spl})	1.3055	1.3011

To calculate the expected change in overall pay/plat ratio (R_{tot}) due to a change in Z, we must hold constant the weights R_{str} and R_{spl}. They can be held constant at either their June 81 levels or their Sept. 82 levels.

1) Using June 1981 weights.
$R_{tot}(81) = (.722)(1.1451) + (1-.722)(1.3055) = 1.1897$
predicted $R_{tot}(82) = (.773)(1.1451) + (1-.773)(1.3055) = 1.1815$
savings rate = (1.1897 - 1.1815)/1.1897 = 0.0069

2) Using September 1982 weights
predicted $R_{tot}(81) = (.722)(1.1877) + (1-.722)(1.3011) = 1.2192$
$R_{tot}(82) = (.733)(1.1877) + (1-.773)(1.3011) = 1.2134$
savngs rate = (1.2192 - 1.2134)/1.2192 = 0.0047

Using the two calculations as bounds, the savings rate due to the change in percentage straights was between 0.47% and 0.69%.

This leaves between 0.9 and 1.2 percentage points of savings attributable to PTLI. As a check on this figure, we will calculate the maximum savings with which PTLI could be credited, under the most generous assumptions.

Let us suppose that in September 1982 the 25 additional PT operators were dismissed, and that their trippers were operated off the extraboard. (In fact, it might be possible to recut the schedule so as to absorb the trippers more efficiently. But OCTD's stated policy is that the presence or absence of the part-time option does not affect runcutting procedure. In any case, our assumption that the run cut is unaltered will tend to slightly overstate the savings due to PTLI, in line with our intention of estimating an upper bound to such savings.) Using the established policy of pairing trippers into combos, 13 additional extraboard operators would be required. Assuming that each combo carries three pay hours of premium pay (and that the unmatched thirty-ninth tripper carries 6 hours of

guarantee pay), then rolling back the increase in part-time operators would have cost an additional 42 hours. That is, the expansion of part-time labor between June 1981 and September 1982 resulted in a per platform hour savings of 0.8%, under the most optimistic assumptions. Under these assumptions, the entire 39-operator part-time force yielded savings of 1.2%. But we stress that this represents a very optimistic upper bound, since the schedule could have been recut to absorb at least some of the trippers.

Additional savings of PTOs may be generated by lower average wage rates and fringe benefits. We can estimate the wage impact of PTOs on the September 1982 schedule as follows. To determine an average PTO wage, we assume that PTOs were hired evenly through the June 1981 through September 1982 shakeups, yielding an average tenure of 9.5 months, which corresponds to a pay rate of 85% of the top rate, or $8.87/hr. We further assume that FTOs are all paid at the top rate of $10.43/hr. The difference in wage cost with and without PTOs is 1.65% (Table A-5). Since this includes the additional pay hours incurred by moving to an all FTO schedule, the wage effect alone accounts for an additional .45% savings.

Recall that the 1980 contract gave full fringe benefits to PTOs. On an hourly basis, PTO fringe costs are actually higher than FTO fringe costs, because both receive the same insurance benefits. Given that the average regular weekday run is 9.5 pay hours, monthly insurance cost per FTO is $1.03/hr. (Insurance is

TABLE A-5
IMPACTS OF PART-TIME LABOR UNDER MOST FAVORABLE ASSUMPTION

Category	Percent Change
Pay Hours	-1.2%
Pay ($)	-.45%
Pay and Fringes	-0%
Total	-1.65%

$200/month.) Assuming each PTO works that maximum 25 hrs/week, the PTO cost is $1.85/hr. Replacing 39 PTOs with 20 FTOs, and calculating the daily insurance cost, we find that there is no fringe savings generated by using PTOs. It may thus be concluded that the introduction of part-time labor yielded negligible cost savings at OCTD.

Changes in the Part-Time Job: Class I and II Operators

The 1983 contract brought further changes for PTOs. The part-time/full-time categories were replaced with a two-class system of operators. Class I operators, whether full or part-time, receive full fringe benefits and are on the same seniority roster. Within the Class I category, part-time positions are limited to 4% of the total full-time bid assignments. The part-time runs have a 20 hr/week guarantee, but otherwise are subject to the earlier contract provisions. Class II operators are all part-time, are permitted to work weekends, receive no fringe benefits, and have a separate seniority list. Class II operators are limited to 6% of the total full-time bid assignments, and cannot be hired until all Class I positions are filled.

Under this system, the assignment of part-time work is a function of the seniority roster. It allows full time operators the option of choosing part-time work without loosing seniority or benefits. A number of full-time operators took advantage of the opportunity and chose part-time runs at the summer shakeup. This freed up full time runs for low seniority operators. Both union and management have been enthusiastic about the new contract provisions. The Class I position provides a new element of flexibility for the full-time operator, while the Class II position provides a lower-cost part-time category. To date, high turnover within Class I has made it impossible to use many Class II drivers, because of the "hire Class I first" provision.

Conclusions

Given its flat schedule and relatively favorable work rules, PTLI was not indicated at OCTD. Savings related to schedule efficiency changes were at most very small. Given the agency's spread threshold, it is likely that an equally efficient all full-time schedule could be cut. Since PTOs were given full benefits, cost savings were also inconsequential. It remains to be seen whether the new Class II category can be utilized sufficiently to generate PTO cost savings.

Winning the right to use PTOs had some cost -- in union/management relationships, if nothing else. It would appear that other productivity improvement strategies might have been more appropriate for this agency. (For example, the change in absentee policy discussed in Chapter Three had considerately greater cost-saving effect.) On the other hand, the new Class I/II system is a promising innovation which has benefits for both labor and management.

SEMTA

Overview and Background

SEMTA is a tri-county transit authority which was formed by state legislation in 1968. It became the pass-through agency for all federal and state transit funds within the tri-county area.

In recent years, SEMTA has suffered from funding uncertainties, as well as the severe economic downturn in the region. Operating costs continued to rise as federal operating subsidies declined, while state and local resources to make up the shortfall were unavailable. At the same time, the rising unemployment caused a drop in transit ridership. In response, substantial service cutbacks (20% in FY82, another 20% in FY83) and fare increases (a total of 30% in FY83) took place, resulting in further ridership losses.

SEMTA now oversees three categories of bus service: linehaul, "small bus", and contract.* The agency operates the linehaul and "small bus" service. The linehaul service includes park-and-ride and regular route service. As of December 1984, the linehaul service comprised 197 peak vehicles, down from over 300 in 1981. Park-and-ride operations make up about 20% of the total linehaul service, and all of the service is "commuter-oriented," with the routes focusing on the downtown area. Linehaul service operators are members of the ATU.

"Small bus" service includes dial-a-ride, flexible route, and intercommunity service. There were 81 peak vehicles as of December 1984. Small bus drivers are members of the Teamster's Union.

The contract service is operated by 6 to 8 local municipalities, and the agency owns the vehicles. SEMTA's primary tasks are to organize and fund these services. Operators are employed by the local agency, and are not covered by the agency's union contracts.

Part-time Operators

Part-time operators are a recent addition to the linehaul service; the small bus service has had part-time drivers since service inception. Our interest here is in

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*Until 1983, SEMTA also operated commuter rail service.

the linehaul transit service. The linehaul service was heavily commuter oriented -- 3.8 peak to base ratio, spread premium after 10.5 hours -- and was an obvious candidate for implementation of part-time operators.

The right to use PTOs for linehaul service was won in the 1980 contract. Part-time operators were limited to 10% of the full-time operators. Other provisions of the agreement included: a limitation of 45% of all PTOs assigned to any one division, PTO work limited to weekday trippers, a 1.5 hour piece minimum, and a 30 hour weekly maximum. Part-time operators were to be laid off first, and the number of weekday runs (which are by definition full-time runs) was set at 280 or more. Like the other case study agencies, PTOs were not entitled to sick or vacation pay, or insurance. The contract also allowed FTOs to switch to temporary part-time status with no loss of full-time seniority.

Because of the PTO lay-off provision, all PTOs were laid-off in the linehaul service reduction of 1982. In addition, SEMTA was never able to implement more than 4 to 5% PTO. Management identified three problems. First, the agency was expanding service, and thus PTOs kept moving up to full-time status. Second, the agency made no effort to identify people who really wanted part-time work. Third, all recruitment took place in the downtown area, while the service garages were located in the suburbs. Consequently, it was difficult to attract potential part-time suburban workers. Given the high rate of unemployment in the area, it was to be expected that most applicants would be seeking full-time work. SEMTA's failure to reach 10% PTOs contributed to their financial problems, as they had projected savings based on the 10% limit and allocated budget accordingly.

The agency's management stated that the cost of obtaining PTL was an additional wage adjustment of $.05/hour, as well as the opportunity cost of not trying to roll back COLA.

The 1983 Contract

By virtue of the number of weekday runs provision, SEMTA has not been able to rehire PTOs. Despite this, an increase of PTOs to 15% of FTOs was negotiated in the 1983 contract. In addition, the percentage limitation applies for peak period rather than to the number of FTOs. No other changes to the part-time provisions were made. It is on the basis of the 1983 part-time provisions that our analysis of schedule efficiency is made.

Schedule Efficiency

We are grateful to SEMTA's chief runcutter for his cooperation in undertaking an experimental runcut. The existing schedule from one garage was recut with and without the full 15% complement of PTOs The results are shown in Table A-6.

TABLE A-6
EFFECT OF PART-TIME LABOR ON SEMTA'S SCHEDULE

	With PTOs	Without PTOs
Pay/Platform	1.160	1.195
Straight runs	14	18
Split runs	47	52
Part-time trippers	14	0
Open trippers	0	4

The schedule savings attributable to part-time labor are about 2.9%. This is substantially less than would have been expected for a service schedule with a peak/base ratio of 3.5. However, SEMTA starts with a set of work rules that are distinctly favorable to management. The most important of these is a provision that prohibits pyramiding of spread premiums and guarantee payments. At many agencies, a split run which both exceeds the spread threshold and falls short of eight hours platform time would earn first, makeup payments to bring basic pay-hours up to the eight hour guarantee; and second, spread premium for work performed past the spread threshold. At SEMTA the spread premium is calculated first, and applied toward the eight hour guarantee. Only if pay hours are less than eight, including spread premium, does the run receive makeup payment. In addition, a maximum of 10 runs per division may be scheduled on a four day per week 10 hours per day schedule. The spread threshold on these runs is 11.5 hours. Thus some of the longest runs can be scheduled with no overtime or premium pay. Consequently, SEMTA's pay/platform is 1.195 (surprisingly efficient given their 3.5 peak/base ratio) even without the use of PTOs. Coincidentally, this is the same schedule efficiency value as that for OCTD, whose peak/base is only 1.2. In short, SEMTA was already running a remarkably efficient schedule without the use of PTOs, so there was not much to be saved by their introduction.

TRI-MET

Background

TRI-MET is a medium-size transit district (642 buses) which provides service in a metropolitan area with a population of approximately 1.2 million. It was established by ordinance in 1969. Local financial support is provided by a .6% employer's payroll tax levied within the three member counties. From its inception, TRI-MET has concentrated on service expansion. During the 1970's, the expansion took place rapidly, as demonstrated in Table A-7 below. Like other transit agencies throughout the U.S., however, operating costs increased much more rapidly than anything else, causing the farebox recovery ratio to plummet from 71% to 29%. Increasing dependence on subsidies required that a larger proportion of the payroll tax be used to support operations. Since TRI-MET also had plans to build a rail system, the diversion of payroll tax revenues from the capital fund was a major concern. Thus by the end of the decade, cost containment became a primary consideration. It was in this environment that PTLI was adopted.

TABLE A-7
TRI-MET SERVICE STATISTICS, 1971 AND 1980

	1971	1980	% Change
Vehicle Hours	735,108	1,543,636	110%
Passenger Trips	16,716,254	40,082,223	140%
Pass/Hr.	22.74	27.46	21%
Operating Revenue	5,920,591	16,369,078	176%
Operating Expense	8,353,185	56,015,994	570%
Rev/Exp.	.71	.29	-59%
Payroll Tax Revenue	8,241,054	32,874,065	298%
Payroll Tax/Op. Exp.	.98	.59	-40%

Source: TRI-MET Annual Report, FY 79-80, actual dollars.

Overview of PTLI

Despite its peak/base ratio of 2.1, TRI-MET was not an obvious candidate for part-time labor, because its traditional work rules had very lenient spread premium

provisions. Regular and extraboard operators were not subject to maximum spread time, and did not earn premium pay until twelve hours.

Impetus for PTLI stemmed from management's desire to increase peak service. Since transit was funded in large part by the payroll tax, there was an implicit obligation to provide commuter service. A previous experiment with outside contractors had provoked great furor. Loadshedding (via vanpools, for instance) was incompatible with the organization's self-image as a service provider. At the same time, management was very sensitive to its public image, and sought to avoid any open conflict between labor and management. Part-time labor was considered the least controversial means to provide peak service at an affordable cost.

Despite union opposition, part-time labor was adopted in 1979. PTOs were given two-piece assignments, subject to a thirteen hour maximum spread. Platform time was limited to six hours daily; neither piece could exceed three hours. The number of PTOs was limited to 10% of the number of FTOs, and the current number of FTOs was to be maintained. The contract also required that equal percentages of PTOs be employed at all divisions. This provision, it developed, severely hampered part-time implementation. The division with the lowest peak/base ratio, with its low PTO requirements, set a binding constraint on PT utilization, since no other division could employ a higher proportion of PTOs. The provision was deleted from the 1982 contract, which also boosted the ceiling on PT employment to 14% of FTOs.

PTOs were paid on the same scale as FTOs, and were entitled to the following fringe benefits: prorated holiday pay and reduced medical coverage after 1 year, prorated vacation after 2 years, and prorated retirement after 5 years. These conditions remained unchanged in the following 1982 contract.

TRI-MET's financial condition deteriorated rapidly in the early 1980's. Because of the region's dependence on the construction industry, the impact of the recession was quite severe. Rising unemployment resulted in a loss of both ridership and payroll tax revenues. Furthermore, service changes which were intended to increase productivity had been unsuccessful, while at the same time administrative costs associated with the rail line construction continued to climb.

These problems culminated in a fiscal crisis in 1984 which necessitated substantial cuts in service. Initially it was feared that all part-time drivers would have to be laid off in order to accomplish the service reduction. This would have been an inefficient way to reduce service, but was dictated by the contractual

priority of FTOs job security over PTOs. The district was eventually able to retain the part-time force by offering FTOs incentives for early retirement or resignation.

Effect of Part-time Implementation on Service Schedule

Despite management's objective of increasing peak service, the peak/base ratio vacillated during the part-time era, initially rising by 7%, then declining to just under the pre-part-time level (Figure A-11). At the same time, vehicle-hours increased substantially (Figure A-12).

FIGURE A-11
PEAK/BASE RATIO

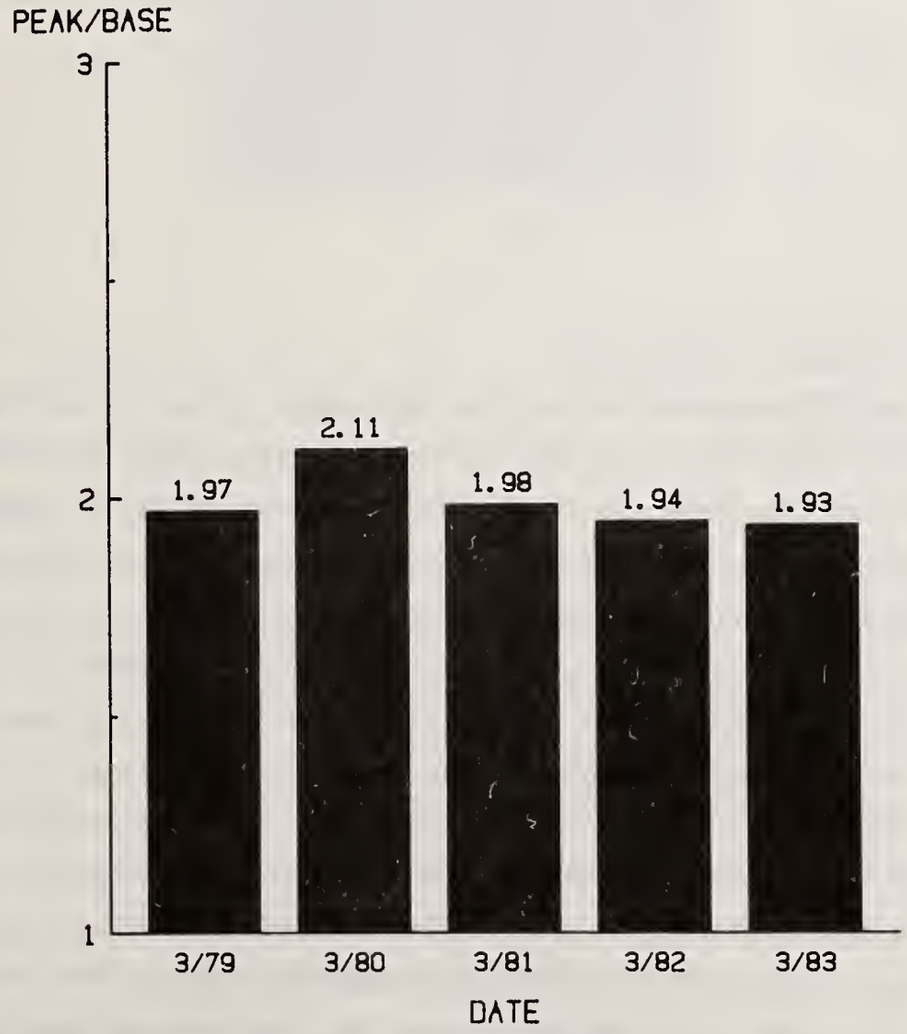
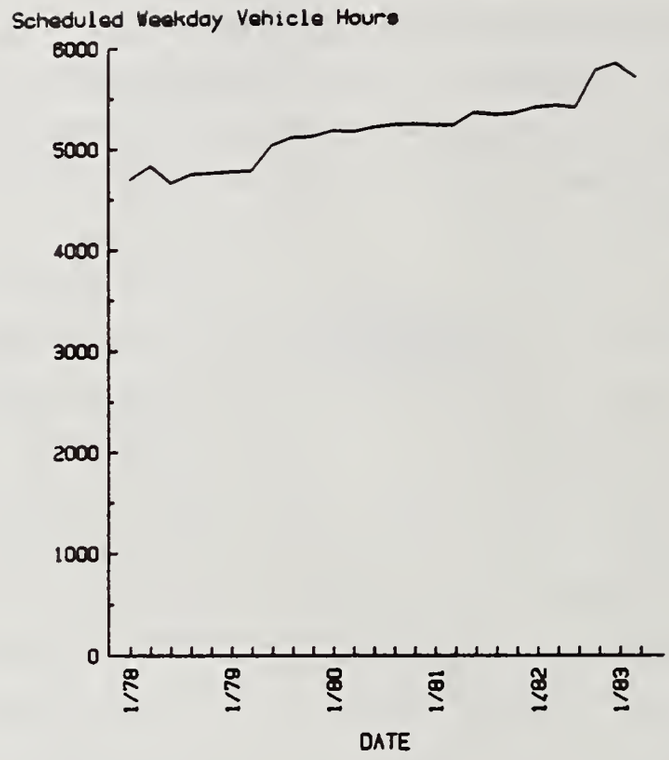


FIGURE A-12
VEHICLE HOURS



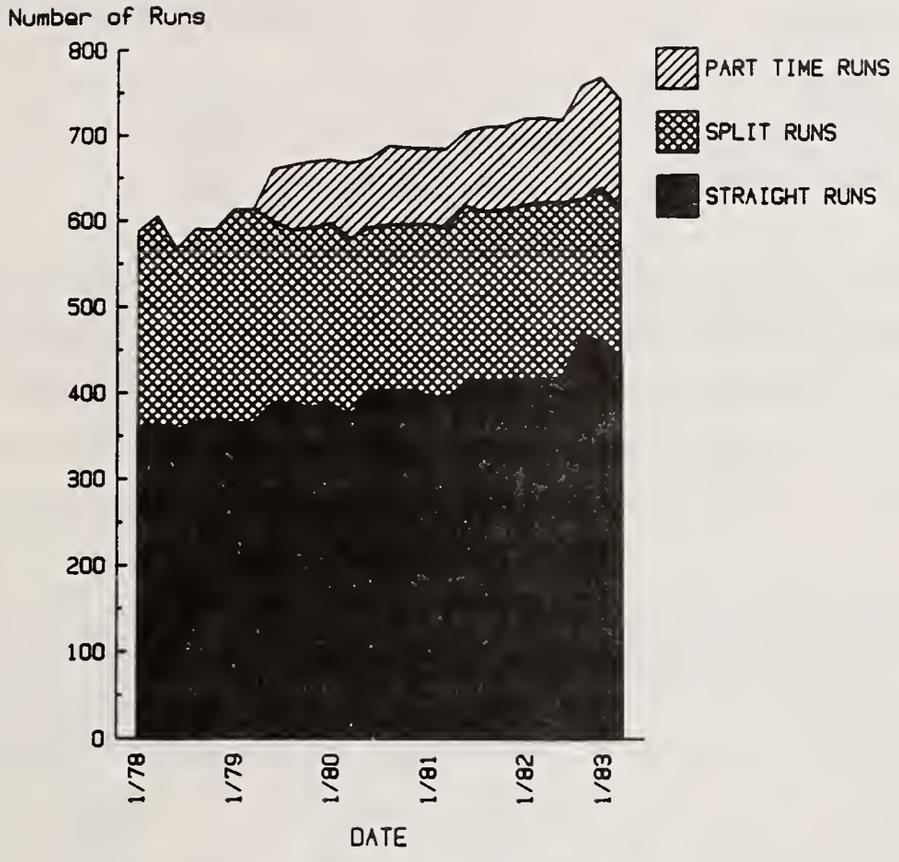
Effect of PTLI on Operator Assignments

The number of PTOs reached a plateau of 90 within a year of first adoption (Figure A-13). When the contract of May 1982 loosened restrictions on the number and deployment of PTOs, scheduled part-time runs jumped up to about 130. Meanwhile, the total number of full-time runs stayed approximately constant during the part-time era, but the run mix changed dramatically. The percentage of split runs declined from 41% to a low of 26%, then recovered slightly to 30%.

These changes can be briefly summarized as follows. After PTLI, the district added new service with approximately the same peak/base ratio as preexisting service. PTOs were assigned to the new peak service, and were also used to displace FTOs from preexisting splits. In order to preserve the mandated number of full-time positions, the displaced FTOs were shifted to new base service.

Clearer insight into the effects of PTLI is provided by a series of experimental runcuts undertaken by the scheduling department. Of chief interest are a pair of runcuts based on a common service schedule; one incorporates part-time operators,

FIGURE A-13
SCHEDULED WEEKDAY RUNS



while the other presumes a 100% full-time force. Far from being mere experiments, these runcuts were intended for actual on-the-street use. They were prepared at a time when there was a possibility that the district would be forced to furlough all part-time operators. Comparison of the two cuts gives the most accurate possible measure of the savings (in scheduled pay and hours) from part-time labor. It is one of the few cases where all the possible confounding influences are held constant.

The comparison is shown in Table A-8. Reducing the full-time force by 83 operators while hiring 117 part-time drivers (10%) cuts total direct labor costs by 5.7%. This translates to a $1.5 million annual savings on weekday service. Of this savings, a little more than half results from an increase in schedule efficiency; the remainder is due to the effectively lower wage rate (because they were still not at the top of the wage progression) and fringe rate for part-time operators. The average full-time operator's wage rate is 22% higher than that of the average part-time operator; fringe costs are 308% higher for full-time operators.

TABLE A-8
IMPACTS OF PART-TIME LABOR
(Change from FTO-only to 10% PTO)

Category	Percentage change
Pay hours	-2.6
Pay ($)	-4.3
Pay + fringes ($)	-5.8
Full-time drivers	-14.5

A different set of runcuts explore the potential savings from raising the limit on part-time employment above 10% of the full-time level. Again, these runcuts employed a standard service schedule, but varying work rules. Table A-9 summarizes the results; it shows the savings, relative to the base 10% scenario, of raising the part-time limit to 15% or 20%.

TABLE A-9
PERCENTAGE SAVINGS FROM INCREMENTAL ADDITIONS OF PTOs
(Relative to Scenario with Max 10% PTOs, "Standard" Rules)

Savings Category	STANDARD RULES		INCREASED STRAIGHTS	
	15% PT	20% PT	15% PT	0% PT
PAY HOURS	0.7	1.6	0.0	0.0
PAY ($)	1.2	2.5	0.2	1.1
PAY + FRINGES ($)	3.0	4.4	0.5	3.1
DECREASE IN FTO'S	2.9	10.3	8.1	11.4

Consider first the columns labeled "standard rules". The assumed work rules for these scenarios differ from the base case principally in the limit on PTOs, though they also allow slightly more flexibility in assigning trippers to PTOs. The table's first row considers the efficiency gain through reduction of scheduled pay hours. Starting from a 10% part-time base, increasing the part-time staff to 15% of the full-time force yields a 0.7% reduction in pay hours; adding another increment of the same size results in a total savings of 1.6%. Because of the PTOs lower average wage rate, the dollar savings are greater than the pay hour savings: 1.2% and 2.5%. The real savings, however, result simply from PTOs lower fringe benefit rates. Factoring in this savings, the total cost reduction is 3.0% in the 15% scenario and 4.4% in the 20% scenario. Note, however, that these savings are predicated on the ability of management to decrease the number of FTOs through attrition. If the

number of full-time positions cannot be decreased, then these are only notional savings achievable by expanding peak service.

A further qualification on these savings is their failure to allow for bargaining concessions as the price of expanded part-time employment. This possibility is explored in the columns labeled "increased straights". These two scenarios call for a small increase in the minimum permissible ratio of straight runs to split runs. (Recall that at TRI-MET, regular operators do not receive spread premiums, so straight runs are greatly preferred.) This slight alteration in ambient work rules entirely wipes out the pay-hour savings from additional PTOs. All that remains is the savings realized by substituting low-fringe PTOs for high-fringe FTOs.

Extraboard and Absentee Policy

Interviews with the agency's management revealed that extraboard staffing and absentee policy were considered to have more cost-saving potential than PTLI. The extraboard at TRI-MET is used exclusively to cover absences. Vacation relief runs are cut with the schedule, and single trippers do not exist. In the event of an extended absence of an operator, his/her work would remain on the extraboard only until the next sign-up. Because staffing decisions are made independently of scheduling decisions, the size of the extraboard is usually determined by the number of surplus FTOs. The agency has historically maintained a "fat" extraboard, as management policy has been to avoid missed runs.

Financial problems cited earlier have led to efforts to reduce the extraboard. In late 1983 a deliberate policy of not replacing terminating FTOs was established. After the January 1984 service cutbacks, extraboard staffing remained low. A second strategy was an absentee reduction program also implemented in 1983. The program has effectively reduced absenteeism, which in turn has made corresponding reductions in extraboard staffing possible.

Absenteeism of PTO's

As at our other agencies, PTOs have had lower absentee rates than the full-time drivers. However, the recent threat to lay off all PTOs shows how sensitive the absentee rate is to morale problems.

TRI-MET warned the PTOs of the impending layoff well in advance of the layoff date. The result was an immediate decline in PTO morale and an increase in

the PTO absentee rate, which ultimately exceeded the absentee rate of the FTOs. This suggests that a substantial portion of the internal "discipline" behind the low PTO absentee rates is their desire for a good record to facilitate their ultimate transfer to full time work. (Further analysis of the absentee data is contained in Chapter Three).

Morale and Recruitment of Part-Time Operators

Interviews with PTOs indicated that after the initial adjustment period, PTOs were accepted by the FTOs. (As at other agencies, TRI-MET's PTOs pay full union dues.) As long as service was increasing, there was ample opportunity for PTOs to move to full-time status. While both management and PTOs estimated that most PTOs are seeking full-time work, they also identified a core group of 15-20 "permanent" PTOs. These are mostly college students who are interested in relatively high wage part-time work and can utilize the break time for studying. On the other hand, the extent to which FT work is the ultimate goal is evidenced by the number of PTOs who have transferred to lower wage FT work at the agency (lower pay rate, but higher weekly salary).

Conclusions

PTLI at TRI-MET served a similar purpose to that of Seattle METRO. It allowed for expansion of peak services which otherwise would have been prohibitively expensive. Given current financial constraints, however it is unlikely that further service expansion will take place.

TRI-MET has been particularly resourceful in its efforts to maintain its PTOs despite service cutbacks. At the other case study agencies with similar layoff provisions, all PTOs were lost as a result of service cutbacks, leading in one case to even more serious fiscal problems. Moreover, the agency has so far been able to "hold the line" on fringe benefit increases: the 1982 contract provides no additional benefits to PTOs. Finally, there is also some indication that an increasing proportion of the agency's PTOs are satisfied with part-time work: in addition to the college students mentioned above, a number of FTOs who had taken early retirement have decided to return to work as long as they can have part-time work.

CCCTA

Background

CCCTA is a newly organized transit agency serving a rapidly growing suburban area. It was formed in 1980 under a joint powers agreement among the member jurisdictions, and initiated operations in 1981 with the takeover of the preexisting 14-vehicle city system. Other local and commuter transit service was provided under contract from a nearby large metropolitan agency. Due to rising costs, CCCTA subsequently took over all the contract service in 1982. Its management was given two mandates: to expand service to meet anticipated growth in demand from the area's burgeoning employment and residential population, and to keep costs strictly under control.

The first objective has been met -- service was boosted 70% over a two year period, and the agency now runs 58 peak vehicles and 155,000 annual vehicle service hours. The new service is not, however, particularly well patronized -- it averages about 18 (unlinked) trips per vehicle hour. Commuters comprise 40% of ridership, accounting for the schedule's 2.3 peak/base ratio, which is rather high for a small suburban agency. An additional 30% of ridership is composed of students.

The second objective has also been fulfilled. Average operating cost is approximately $32 per vehicle service hour. This efficiency is traceable to an extremely tough, strictly enforced labor agreement. Because the agency was organized under the Meyers-Milias-Brown Act, union membership is not mandatory (i.e., there is no automatic checkoff of dues). Employees are not permitted to strike or engage in slowdowns; such activity is cause for dismissal. The General Manager has formatted a strike contingency plan, and says that in the event of a strike, "I'd PATCO 'em" (referring to the dismissal of striking air traffic controllers). Although the labor agreement is negotiated, management has the right to unilaterally impose rules in the event that the parties fail to agree.

Given the lack of union leverage, it is not surprising that only one third of the operators belong to the union, or that the work rules are more stringent than those found at many other agencies. This is particularly true with respect to part-time labor utilization, which is unusually intensive both in regular and extraboard operations.

Part-Time Labor at CCCTA and Overall Scheduling Efficiency

Part-time labor was a part of the agency's initial labor agreement. The part-time provisions are unusual in a number of ways. First, there is no restriction on either the total number of PTOs or the PTO/FTO ratio. Second, there are practically no restrictions on part-time work: PTOs are "generally" limited to 30 hrs. per week, however they are eligible for all types of work, including the extraboard. In addition, there is no protection of full-time positions. In the event of a service reduction, PTOs do not have to be laid off first; however a laid-off FTO does have the right to take a PT position since FTOs have higher seniority. As a result of these flexible provisions, PTOs handle more than a quarter of all regular weekly assignments (Table A-10).

TABLE A-10
BREAKDOWN OF WEEKLY ASSIGNMENTS

Full-Time: Straight runs	44.7%
Full-Time: Split runs	27.7%
Part-Time	27.7%

Note that there are as many full-time split run assignments as there are part-time assignments. There is no statutory reason to prevent the agency from converting each split run into two part-time assignments. The benefit of doing so would be comparatively small, however. Because the spread premium threshold is at twelve hours, the total payment of spread premiums is essentially nil. FTOs do receive higher fringe benefits; but the agency's current policy is to employ as many FTOs as possible without incurring significant spread or guarantee payments. The comparatively high turnover rate among PTOs was also cited as an important consideration. Although the 30 hours/week PTO limitation is not contractually binding, all regular PTOs are in fact scheduled to work between 28 and 30 hours/week. Each assignment consists of a full Saturday run of 8 to 10 hours, and four or five weekday pieces (no more than one daily) of 3 to 6 hours. (The agency does not operate Sunday service.)

The intensive use of part-time labor, together with the low incidence of spread premiums, permits highly efficient scheduling. That efficiency is enhanced by feedback from the run cut to the service schedule -- vehicle blocks can be readjusted to facilitate driver scheduling. As a result, CCCTA's pay/platform ratio

is 1.04, which is almost indistinguishable from the theoretical minimum. (The ratio differs from unity because drivers are paid 10 minutes for report and clear, i.e., sign-in and sign-out.) This compares with typical pay/platform ratios of 1.20 at agencies with comparable peak/base ratios[21] Thus CCCTA is approximately 15% more schedule-efficient than comparable agencies, due largely to its extensive use of part-time labor.

A Part-time Extraboard

The extraboard is an insurance device: it serves as a backup to assure that scheduled runs will be operated, regardless of absenteeism among the scheduled operators. At most agencies, extraboards are staffed by FTOs, and the size of the extraboard is more or less fixed between signups. Consequently, extraboards are necessarily underutilized on low-absence days and overworked on high-absence days. Extraboard operators therefore tend to collect guarantee payments on the low-absence days, when they report for duty but are not needed. On high absence days, an extraboard operator may be assigned both a tripper and a regular run, thus earning overtime and/or spread premium payments.

CCCTA is unusual in having an extraboard staffed entirely by PTOs. Absences, vacations, and charter runs are covered by the extraboard. Extraboard work is performed by the lowest seniority PTOs. The extraboard PTOs are divided into three groups: groups "A" and "B" are subject to report for different three day segments, while group "C" is subject to report all six days. New operators start out in group "C", and must work their way up through the extraboard ranks before they can bid on regular part-time runs. There is no guarantee of work, either daily or weekly. Extraboard operators must call in daily. If they are required to report, they receive a two hour guarantee. Overtime is paid only after 10 hours/day or 40 hours/week, and for all practical purposes, extraboard operators are ineligible for spread premium.

In many ways these arrangements are similar to the prevailing extraboard practice of several decades ago. Extraboard costs are kept extremely low, but extraboard operators must cope with severe uncertainty of income as well as

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21K.M. Chomitz & C.A. Lave (1984). Part-time labour, work rules, and urban transit costs. Journal of transport Economics and Policy, 18(1), p. 71.

schedule. These conditions have been cited by management as a being a cause of the high turnover rate among PTOs.

Working Conditions, Turnover, and Training

In addition to the extensive use of PTOs and the unusual degree of management control at CCCTA, wage rates are significantly below those of other transit agencies within the area. The 1984 starting wage is $6.79/hour, and the top wage is $8.49/hour. It requires four years at full-time status to reach the top rate. PTOs are paid on the same scale, but with a slightly more liberal progression. CCCTA's management points out that working conditions are more pleasant in this suburban area than in the nearby urban areas, and therefore lower wages are justified. Fringe benefits are typical of other transit agencies with sick, vacation, holiday pay, and insurance provided. PTOs receive only vacation which is accrued after 500 hours at the rate of 1 day per 173 hours worked (about 9 days per year).

TABLE A-11
DRIVER SEPARATIONS AT CCCTA

	1983	1984
Full-Time		
Average number employed	54	63
Number separated	12	12*
Sep. as % of emp.	22%	19%
Part-Time		
Average number employed	45	55
Number separated	33	43*
Sep. as % of emp.	73%	78%

*Annualized estimate based on 8 months data

Turnover was cited by CCCTA as a serious problem, particularly among the PTOs. Table A-11 gives the number of separations for FTOs and PTOs for calendar year 1983 and 1984. The separation rate is far higher for PTOs than FTOs. (PTOs moving to FT status were not counted as "separations"). The numbers indicate that roughly three fourths of the PTOs are replaced each year.

What does the turnover cost? Given training costs of approximately $1,140 per driver, and assuming an average PTO tenure of six months, if the PTO works the

maximum 30 hours/week, then training costs are $1.46/pay hour, or an additional 21% of the starting wage. In fact, beginning PTOs do not generally work 30 hours/week because they are assigned to the extraboard. Since far more PTOs resign than are terminated, it seems clear that working conditions are a primary cause of the high turnover rate. In particular, the irregular schedules and pay associated with intial service on the extraboard are a likely cause of the problem. We were not able to make an estimate of how much management saves by staffing the extraboard with PTOs, but given the extra training costs this engenders, it is likely that a substantial portion of the savings are offset by the resultant turnover.

A related problem is that of recruitment. Because of the irregular hours associated with the entry PTO position, anyone with schedule constraints is ineligible, e.g. students, women with small children, etc. In an effort to keep positions filled, CCCTA advertises regularly and hires an average of 10 to 12 persons/month. Since full-time positions are filled from the part-time ranks, only PTOs are recruited.

Conclusions

CCCTA has achieved an exceptional level of efficiency because of a high degree of interaction between the service schedule and runcutting, extensive use of PTOs, relatively low wages, and aggressive management. On the other hand, working conditions for the entry PTOs are well below industry standards, and PTO turnover rates are unusually high.

APPENDIX B: GLOSSARY

CLOCK-IN -- The time when a driver reports for assignment at the start of the working day.

CLOCK-OUT -- The time when a driver leaves his job at the end of the working day.

DIVISION -- The collection of bus runs based at a single garage.

EXTRABOARD -- The group of operators responsible for covering runs left open by sick or absent operators.

FTOs -- Full-time operators.

GARAGE -- see DIVISION.

MAX SPREAD, MAXIMUM SPREAD -- Longest permissible spread time for an operator.

PAY HOUR -- A unit of money equivalent to one hour of straight-time wage.

PAY/PLAT, PAY/PLATFORM -- A measure of schedule efficiency. Hours of pay received divided by hours of platform time worked.

PEAK/BASE RATIO -- Total buses in service during the peak commuting hour divided by the number of buses in service at midday.

PIECE -- An unbroken driver assignment.

PLATFORM TIME, PLATFORM HOURS -- Actual time in a day's assignment during which the operator is in charge of the vehicle, whether it is in motion or not: the time between pull-out and pull-in.

PTOs -- Part-time operators.

PTLI -- Part-time labor implementation.

PULL-IN -- The time at which a vehicle returns to the garage from a regularly scheduled trip.

PULL-OUT -- The time at which a vehicle leaves the garage to begin a regularly scheduled trip.

REGULAR OPERATORS -- In this report, full-time operators.

REGULAR RUN -- The combination of regularly scheduled trips making up an assignment for a full-time operator.

RUN -- see REGULAR RUN.

SCHEDULE EFFICIENCY -- see PAY/PLAT.

SERVICE PROFILE -- The graph of number of buses in service by hour of the day. See also PEAK-BASE RATIO.

SPLIT RUN -- A run split into several pieces, containing an unpaid break.

SPREAD LIMIT -- see MAXIMUM SPREAD.

SPREAD PREMIUM PAY -- The extra pay given to operators as compensation for very long split runs. An operator typically receives time-and-a-half for the period longer than the spread penalty time. For example, under a contract with a spread penalty time of 10 hours, an operator with twelve hours of spread between clock-in and clock-out would receive an extra hour of premium pay.

STRAIGHT RUN -- A run without an unpaid piece in the middle.

TRIPPER -- Short operator assignment, 1-6 hours.

TWO PIECE RUN -- see SPLIT RUN.

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